

**AGENCE SPATIALE CANADIENNE  
CANADIAN SPACE AGENCY**



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**REPLACEMENT OF THE GENERATOR**  
**TECHNICAL SPECIFICATIONS**  
**MECHANICAL**

**For permit and tender**

**Prepared and verified by**

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**Division 21: Fire protection**

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## **1. PART 1 – GENERAL**

### **1.1 General**

- .1 All fire protection work shall be executed by a specialized contractor well known in that field, and in accordance with ANSI/NFPA 13, Installation of Sprinkler Systems, and FC 403, Sprinkler Systems.

### **1.2 Shop Drawings and Product Data**

- .1 Submit shop drawings, product data, working plans required.

### **1.3 Engineering Design Criteria**

- .1 Design system in accordance with ANSI/NFPA 13, using following parameters:
  - .1 Hazard:
    - .1 As indicated on plans.
  - .2 Pipes size and layout:
    - .1 Sizing design according to pipe schedule table.
    - .2 Sprinkler head layout: to ANSI/NFPA 13.

## **2. PART 2 – PRODUCTS**

### **2.1 Pipe, Fittings and Valves**

- .1 Pipe:
  - .1 Ferrous: to ANSI/NFPA 13.
- .2 Fittings and joints to ANSI-NFPA 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
- .3 Pipe hangers:
  - .1 ULC listed for fire protection services.

### **2.2 Sprinkler Heads**

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services, semi-recessed, chrome finished.

### **3. PART 3 – EXECUTION**

- 3.1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13.
- 3.2 Supply and install all new pipes and sprinklers heads and all other work as indicated on drawings for a complete and operational installation.
- 3.3 Remove the existing sprinkler heads as shown on drawings or as indicated in another part of these specifications. Proceed with the removal of the piping and accessories of the existing system covering the zone touched by the project and connect the sprinklers supply line to the existing pressurized water sprinklers main pipe in the generator room
- 3.4 Contractor may have to remove existing heads and existing piping in order to clear the space for lighting fixtures, ductwork or to comply with new layout and equipment installation. Priority has to be given to HVAC equipment for space usage. Contractor will relocate all branches and 50mm ø (2"ø) and less pipes in order to comply with the new HVAC layout with no extra fees to customer.
- 3.5 Provide drain plugs at all lower pipe portions to allow drainage of the floor sprinkler network.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 General**

- .1 This section applies to mechanical works indicated on plans and in attached Divisions 21 and 23 that form the Mechanical Specification.
- .2 This section complements all contract clauses, all general clauses of Architectural Specifications and Departmental Representative clauses. Most restrictive clauses take precedence.
- .3 These Mechanical Specifications concern the Contractor responsible for the whole works and the Mechanical Contractors. The Contractor responsible for the whole works has overall responsibility and ensures good coordination for work performed by its Mechanical Contractors regarding the work. The Contractor responsible for the whole works must resolve any conflict that arises between Contractors. The word "Contractor" in this specifications document means the Contractor responsible for the whole works.
- .4 Responsibilities – Scope of work
  - .1 Work described in sections of divisions below is an integral part of the responsibilities of the Contractor:
    - .1 Division 21: Fire protection.
    - .2 Division 22: Plumbing and petroleum installations.
    - .3 Division 23: HVAC, including HVAC ductwork and accessories.
  - .2 The work described on the following plans are an integral part of the Contractor responsibilities:

<b>CSA project file no.</b>	<b>Project title</b>	<b>Mechanical drawings No.</b>
	Replacement of the generator	H-01A, H-01B to H-11

- .3 The drawings and specifications complete each other and shall be read together in order to well understand the scope of work and associated specifications.
- .4 Particular notes regarding works:
  - .1 The sprinklers work and other relative fire protection works (mechanical div. 21) shall be performed by a fire protection subcontractor under General Contractor's responsibility.
  - .2 The plumbing work (mechanical div. 22) shall be performed by a plumbing subcontractor under General Contractor's responsibility. For the petroleum installations, a specialised subcontractor owning the pertinent licences for these works shall be involved and be under the responsibility of the General contractor.
  - .3 All ventilation works are by the HVAC subcontractor (div. 23 of mechanical).
  - .4 All thermal insulation works are under the responsibility of each discipline plumbing / piping and ventilation, but by a well licensed thermal insulation specialist (see appropriated action covering thermal insulation).
  - .5 Controls systems work will be done by a specialist as subcontractor (see section 230933E of these specifications) under Ventilation Contractor's responsibility.

### **1.2 Codes and standards**

- .1 Unless otherwise stated, work shall be done in accordance with National Building Code of Canada (NBC), and any other applicable provincial or municipal code. In case of omissions and contradictions between these standards, the most stringent requirements shall apply.
- .2 Work must comply with or exceed requirements of standards, codes and other documents referred to.

### 1.3 Equipment and materials

#### .1 Quality

- .1 Equipment and materials used in performing the work must be new (unless otherwise indicated), in perfect condition, manufactured, assembled and tested at the factory, of the highest quality in accordance with terms and conditions of contract documents and ready to be installed for intended purpose; if necessary, provide evidence showing nature, origin and quality of supplied products.
- .2 Equipment and materials shall be affixed with appropriate CSA, ULC or other certification labels, and be installed in accordance with applicable codes and standards.
- .3 All markings on equipment and materials (operating instructions or other) must be in French.
- .4 Equipment and materials found defective before completion of work will be rejected, whatever the findings of previous inspections. Inspections are not intended to relieve Contractor of his responsibilities, but simply to reduce the risk of omission or error. The Contractor shall ensure removal and replacement of defective products at his own expense, and will be held responsible for delays and costs.
- .5 In the event of conflict regarding quality or suitability of products, only the Departmental Representative shall settle the matter, based on the requirements of contract documents.
- .6 Unless otherwise indicated, ensure some degree of uniformity by ensuring that equipment or material of a similar nature come from the same manufacturer, that they are the same standard product from a manufacturer and that parts required for maintenance are available at all times.
- .7 Labels, trademarks and permanent nameplates affixed in a conspicuous way on to be installed equipment or materials are not acceptable unless they contain operating instructions or they are affixed on equipment or material installed in mechanical or electrical rooms.
- .8 Equipment or material shall have specifications and dimensions suitable for sites where they will be installed. Notify the Departmental Representative before installing equipment or material which does not respect these conditions.

#### .2 Availability

- .1 Immediately after award of contract, review requirements for delivery of equipment or material and anticipate any delay. Order required quantities in a timely manner, taking into account work schedule and storage capacity on site. If some delays in delivery is to be anticipated, notify the Departmental Representative so that measures can be taken to substitute equipment or material for alternative ones or make necessary corrections sufficiently in advance to avoid any delay in project.
- .2 In the event that the Departmental Representative had not been notified of delays in delivery that could have been anticipated prior to work, and that it seems likely that execution of work will be delayed, the Departmental Representative reserves the right to change planned equipment or materials for comparable equipment or materials that can be delivered more quickly, without any increase in contract prices.

#### .3 Transportation

- .1 Pay for the cost of transportation for equipment or materials required for executing the work.
- .2 Departmental Representative will pay the cost of transportation for equipment or materials supplied by the Departmental Representative. Assume responsibility for unloading, handling and storing equipment and materials. The Contractor will supply lifting equipment required from delivery point to installation point of equipment and materials.
- .3 Coordinate deliveries and pay demurrage charges.

#### .4 Storage, handling and protection of equipment or materials

- .1 Contractor is responsible for the inspection of equipment and materials arriving on site, their storage, installation and connection.
- .2 Move and store in locked premises equipment and materials, avoiding damage, alteration or dirt

and following manufacturer's instructions wherever applicable.

- .3 Store equipment and materials in their original packaging, and leave intact manufacturer's labels and seals. Do not unpack or untie equipment or materials prior to their inclusion to the work.
- .4 Equipment or materials that could be damaged by adverse conditions must be kept in suitable premises.
- .5 Replace at no additional cost damaged equipment or materials, to Departmental Representative satisfaction.

#### 1.4 Manufacturers recommendations

- .1 Unless otherwise indicated, install or set up equipment or materials following manufacturer's instructions.
- .2 Do not rely on information contained on labels and containers provided with equipment or materials; obtain directly from the manufacturer diagrams, drawings, and all written instructions required for proper installation of equipment and all other information that could facilitate the work.
- .3 Copy of these instructions will be given to the Departmental Representative prior to installation.
- .4 The Departmental Representative may require removal and reinstallation, without increase of contract price, of all products that were put or installed incorrectly.

#### 1.5 Implementation

- .1 General
  - .1 Implementation shall be of the highest quality possible and be done to good engineering practices, codes and standards in force, by teams of experienced workers, composed of professional workers skilled in their respective trade. Notify the Departmental Representative immediately if the nature of work to be performed is such that it would be almost impossible to obtain anticipated results.
  - .2 Do not hire unskilled persons not having adequate qualifications to perform work they have been assigned. The Departmental Representative reserves the right to demand the lay-off of any person deemed incompetent, negligent, insubordinate or whose presence should not be tolerated on site.
- .2 Concealment of pipes
  - .1 In finished areas, conceal pipes, ducts and electrical wiring in ceilings, walls and floors, unless otherwise indicated.
  - .2 Before concealing pipes, notify Departmental Representative of any abnormal situation. Proceed to install in accordance with the instructions of the Departmental Representative.
  - .3 No work, such as pipes, conduits, etc., will be concealed until it has been inspected and approved.
- .3 Cutting and patching
  - .1 Cutting and patching work to be done such that all parts of the work form a coherent whole. Coordinate work accordingly.
  - .2 Cutting and patching work must be performed by specialists familiar with materials they are going to use. Work to be done so as not to damage or risk to damage any part of structure.
- .4 Location of equipment and materials
  - .1 The exact location of equipment or materials for which location is defined only schematically on plans will be made jointly with the Departmental Representative on site; location can be changed at no additional charge or credit, provided that displacements do not exceed 5 m.
  - .2 Install equipment, materials and pipes in order to limit overall dimensions and to conserve as much floor space as possible in accordance with manufacturer's recommendations as to safety,

- access and maintenance.
- .3 Inform the Departmental Representative of any problem that may be caused by the location of equipment or material, and install according to his instructions.
- .4 If access traps need to be installed for maintenance or access to equipment or materials, obtain approval of Departmental Representative before installation. Supply and installation of access traps will be made at no additional cost for the Departmental Representative.
- .5 Concrete pouring, excavation and backfilling
  - .1 Concrete pouring, excavation and backfilling required for work in accordance with this division will be borne by other divisions unless otherwise indicated on plans or specifications of each individual division.
  - .2 When trenches or concrete bases are required for equipment, each division will identify required dimensions, determine the exact location and monitor it to ensure proper execution of work in accordance with plans and specifications.
- .6 Existing installations
  - .1 When connection works to existing systems are required, connect at times established by responsible authorities, with minimum disruption of normal usage of premises, tenants and pedestrian and vehicle traffic.
  - .2 Repair any damage to facilities and systems during connection works.
  - .3 Protect, move or maintain in service existing pipes. If abandoned pipes are discovered during work, they should be closed and identified by signs, or their location should be recorded. Seal conduits, pipes, etc., in accordance with applicable codes and standards.
  - .4 Submit to the Departmental Representative the work schedule and obtain his approval for temporary shutdown of existing systems or services. Cut services according to approved schedule and notify in advance those affected.
  - .5 Any interruption of service must be coordinated in writing with the Departmental Representative, at least forty-eight (48) hours in advance, unless otherwise specified in writing by the Departmental Representative.
  - .6 Unless otherwise specified by the Departmental Representative, connection to existing systems must be carried without service disruption.
  - .7 Reusable existing equipment will be dismantled carefully, stored in a climate controlled room, cleaned and reinstalled in accordance with manufacturer's recommendations.
- .7 Start-up
  - .1 Contractor shall include in his bid services required to ensure, upon completion of work, start-up, coordination and integration of mechanical systems and their adjustment for optimum operation.
  - .2 Start-up must be performed for a full season, such as heating in winter and air conditioning in summer in the case of an air-conditioned building. When start-up is carried out through a heating period, the Contractor will have to come back and perform start-up during an air conditioning period, or vice-versa.

#### 1.6 Tests and certification

- .1 Upon completion of work, demonstrate that all equipment is working as designed. If required, a second series of tests will be done within a period of two (2) weeks after the first one. Submit test report to the Departmental Representative.
- .2 Execute testing and supply all equipment required. Notify the Departmental Representative twenty-four (24) hours in advance so that his operating and maintenance staff can be on site to attend tests and help if required.
- .3 Manufacturer of equipment shall be present on site for start-up and give necessary instructions to maintenance staff.
- .4 Refer to the description of each section for specific tests requested.



- .5 Submittal of test reports will be a condition for acceptance of work by the Departmental Representative.
- .6 Submit all certificates required by regulations, laws and contract.

#### 1.7 Repairs

- .1 If necessary, repair any damage caused to existing or new installations and systems, in the course of carrying the work.
- .2 No additional charge will be granted when work has to be redone due to error, omission or lack of coordination on part of the Contractor.

#### 1.8 Equipment location

- .1 Location of equipment and materials indicated or specified must be regarded as approximate.
- .2 Install equipment and piping in order to limit overall dimensions and conserve as much floor space as possible, in accordance with manufacturer's recommendations as to safety, access and maintenance.
- .3 At the request of the Departmental Representative, submit a layout plan indicating the relative position of various services and equipment parts.
- .4 The Contractor shall respect perfect symmetry between the various parts of systems in each trade. Moreover, it should be noted that plans are provided as a guide and are sometimes at a small scale and do not always present elevations and dimensions. Therefore, judgment is required to ensure that fittings for those systems are well integrated to the structure and the architecture of the building.
- .5 Location of major equipment, even if it is indicated accurately on drawings, may be modified at any time by the Departmental Representative if required in his judgment by existing conditions, at no additional cost to the Departmental Representative when it is specified prior to installation.
- .6 Pull and junction boxes must be located in protected and easily accessible locations.
- .7 If equipment is installed without regard to these Specifications and constitutes an obstacle or is damaged, the Contractor must displace it or replace at no additional cost to the Departmental Representative.
- .8 Respect applicable laws and codes regarding working space around equipment.

#### 1.9 Levels and grades

- .1 Before proceeding with installation of pipes, cable-trays and other equipment, check all levels and grades indicated on drawings to ensure that required slopes can be obtained and that there is no interference between trades.
- .2 Failure to notify the Departmental Representative about errors found on drawings will make the Contractor responsible for any necessary change, without additional compensation.

#### 1.10 Protection against corrosion

- .1 All galvanized steel parts support for piping, anchors, machinery or other must be coated on site with one (1) layer of anti-corrosion paint after metallic surfaces are cleaned.
- .2 All caps, screws, etc., outside will be either in bronze or cadmium plated.

#### 1.11 Anchoring

- .1 No anchor gun shall be used, unless otherwise authorized by the Departmental Representative. Expansion bolts shall be used to secure pipes to walls or ceilings. The Departmental Representative reserve the right to ask for any type of anchoring they consider particularly suited to conditions of construction work, at no extra cost.
- .2 Anchoring used to support equipment other than pipes on concrete walls and ceilings will be of HILTI type, HVA series and on hollow block walls, HILTI, series HY20.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 References**

- .1 National Fire Protection Association (NFPA):
  - .1 NFPA-13, Standard for installation sprinklers.
- .2 National Building Code of Canada (NBC)-2010.
- .3 SMACNA 1338 "Seismic restraint manual guidelines for mechanical systems", including addendum no. 1.
- .4 ASTM E – 488.
- .5 ASHRAE – Applications handbook.

## **2. PART 2 – PRODUCTS**

### **2.1 General**

- .1 Size and shape of bases type and performance of vibration isolation as indicated.
- .2 Each mechanical and electrical contractor is responsible for the seismic controls related to this discipline.

### **2.2 Seismic control measures**

- .1 General:
  - .1 Following systems and/or equipment to remain operational during and after earthquakes or similar events:
    - .1 Water, oil, air and gas piping.
    - .2 HVAC fans, duct works and equipment.
  - .2 Seismic control systems to work in every direction.
  - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
  - .4 Drilled or power driven anchors and fasteners not permitted.
  - .5 No equipment, equipment supports or mounts to fail before failure of structure.
  - .6 Supports of cast iron or threaded pipe not permitted.
  - .7 Seismic control measures not to interfere with integrity of firestopping.
- .2 Static equipment:
  - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
  - .2 Suspended equipment:
    - .1 Use one or more of following methods depending upon site conditions:
      - .1 Install tight to structure.
      - .2 Cross brace in every direction.
      - .3 Brace back to structure.
      - .4 Cable restraint system.
  - .3 Seismic restraints:
    - .1 Cushioning action gentle and steady.
    - .2 Never reach metal-like stiffness.
- .3 Vibration isolated equipment:
  - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
  - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.

- .4 Piping systems:
  - .1 Fire protection systems: to NFPA 13.
  - .2 All other piping systems: hangers longer than 300 mm braced at each hanger.
  - .3 Compatible with requirements for anchoring and guiding of piping systems.
- .5 Bracing methods:
  - .1 Approved by Engineer hired by the contractor at his own expenses.
  - .2 Structural angles or channels.
  - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

### 3. **PART 3 – EXECUTION**

#### 3.1 Manufacturer's instructions

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

#### 3.2 Installation

- .1 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

#### 3.3 Field quality control

- .1 Manufacturer's Field Services:
  - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
  - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation:
  - .3 Submit manufacturer's reports to Departmental Representative within five (5) days of manufacturer representative's review.
  - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
  - .1 Experienced and competent sound and vibration testing professional engineer to certify the protection devices for HVAC systems after start up and TAB of systems.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 References**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60-M89, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .2 Canadian Gas Association (CGA)
  - .1 CSA/CGA B149.1-15.

### **1.2 Submittals**

- .1 Submittals: as required.
- .2 Product data to include paint colour chips, other products specified in this section.

### **1.3 Samples**

- .1 Submit samples required.
- .2 Samples to include nameplates, labels, tags, lists of proposed legends.

## **2. PART 2 – PRODUCTS**

### **2.1 Manufacturer's equipment nameplates**

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .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.

### **2.2 System nameplates**

- .1 Colours:
  - .1 Hazardous: RED letters, WHITE background.
  - .2 Elsewhere: BLACK letters, WHITE background (except where required otherwise by applicable codes).
- .2 Material and construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	12 x 50	1	3
2	12 x 75	1	6
3	12 x 75	2	3
4	19 x 100	1	9
5	19 x 100	2	6
6	19 x 200	1	9
7	25 x 125	1	12
8	25 x 125	2	9
9	38 x 200	1	19

.2 Use maximum of 25 letters/numbers per line.

2.3 Existing identification systems

- .1 Apply existing identification system to new work.
- .2 Before starting work, obtain written approval of identification system from the Departmental Representative.

2.4 Piping systems governed by codes

- .1 Natural gas: to CSA/CGA B149.1.
- .2 Diesel fuel: to CAN/CSA B139

2.5 Identification of piping systems

- .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 Pictograms:
  - .1 Where required: to Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 19 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°F.

.7 Colors and Legends:

- .1 Where not listed, obtain direction from Departmental Representative.
- .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

<u>Contents</u>	<u>Background colour marking</u>	<u>Legend</u>
Treated water	Green	TREATED WATER
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	GLYC. HEATING RETURN
Condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS
Plumbing vent	Green	SAN. VENT
Diesel fuel supply to generator	Yellow	DIESEL SUPPLY GE
Diesel fuel return from generator	Yellow	DIESEL RETURN GE

2.6 Valves, controllers identification

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 Controller and system component identification

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 Language

- .1 Identification of systems and components: bilingual in French and in English.

### **3. PART 3 – EXECUTION**

#### **3.1 Installation**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide “ULC” and/or “CSA” registration plates as required by respective agency.

#### **3.2 Nameplates**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
  - .1 Do not paint, insulate or cover.

#### **3.3 Location of identification on piping and ductwork systems**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 15 meters intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .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.
- .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.

#### **3.4 Valves, controllers**

- .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.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 General**

- .1 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.
- .2 Air systems are under responsibility of ventilation subcontractor, hydronic systems are under responsibility of plumbing subcontractor and the petroleum installations are under the responsibility of the specialized petroleum subcontractor.

### **1.2 Qualifications of TAB personnel**

- .1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.

### **1.3 Purpose of TAB**

- .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
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

### **1.4 Exceptions**

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

### **1.5 Co-ordination**

- .1 Schedule time required for TAB (including repairs, re testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

### **1.6 Pre-TAB Review**

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to the Departmental Representative in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.



### 1.7 Start-Up

- .1 Follow start up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start up procedures specified elsewhere in Division 23.

### 1.8 Operation of systems during TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

### 1.9 Start of TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, caulking.
- .5 All pressure, leakage, other tests specified elsewhere Divisions 22 and 23.
- .6 All provisions for TAB installed and operational;
- .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 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
    - .4 Correct fan rotation.
    - .5 Fire, smoke, volume control dampers installed and open.
    - .6 Coil fins combed, clean.
    - .7 Access doors, installed, closed.
    - .8 Outlets installed, volume control dampers open.
  - .3 Liquid systems:
    - .1 Flushed, filled, vented.
    - .2 Correct pump rotation.
    - .3 Strainers in place, baskets clean.
    - .4 Isolating and balancing valves installed, open.
    - .5 Calibrated balancing valves installed, at factory settings.
    - .6 Chemical treatment systems complete, operational.
  - .4 Petroleum Systems
    - .1 Watertight piping and leak tests completed.
    - .2 Filters installed and clean.
    - .3 Pumping system in good working order including controls.
    - .4 Operational, programming and verified diesel fuel management and supervision system.

### 1.10 Application tolerances

- .1 Do TAB to following tolerances of design values:
  - HVAC systems: plus 5 %, minus 5 %.
  - Hydronic systems: plus or minus 10 %.

#### 1.11 Accuracy tolerances

- .1 Measured values to be accurate to within plus or minus 2 % of actual values.

#### 1.12 Instruments

- .1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

#### 1.13 Submittals

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

#### 1.14 Preliminary report

- .1 Submit for checking and approval of Departmental Representative, 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.

#### 1.15 TAB report

- .1 Format to be in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in both official languages, French and English, in D ring binders, complete with index tabs.

#### 1.16 Verification

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

#### 1.17 Settings

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

### 1.18 Completion of TAB

- .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

### 1.19 Air systems

- .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC, NEBB, SMACNA, ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Divisions 21 and 23 following systems, equipment, components, controls:
- .3 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross sectional area, RPM, electrical power, voltage, noise, vibration.
- .4 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of dampers, filters, heating/cooling coils, humidifiers, fans, other equipment causing changes in conditions.
  - .2 At controllers, controlled devices.
- .5 Locations of systems measurements to include, but not be limited to, following as appropriate: main ducts, main branch, sub branch, run out (or grille, register or diffuser).).

### 1.20 Hydronic systems

- .1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.
- .2 Standard: TAB to be to most stringent of this section or TAB standards of A AABC, NEBB, SMACNA, ASHRAE.
- .3 Do TAB of systems, equipment, components, controls specified Division 23 following systems, equipment, components, controls:
- .4 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.
- .5 Locations of equipment measurement: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of heat exchangers (primary and secondary sides), boilers, chillers, heating/cooling coils, humidifiers, cooling towers, condensers, pumps, PRV, control valves, other equipment causing changes in conditions.
  - .2 At controllers, controlled devices.
- .6 Locations of systems measurements to include, but not be limited to, following as appropriate: supply and return of primary and secondary loops (main, main branch, branch, sub branch of all hydronic systems, inlet connection of make up water).

### 1.21 Other systems

- .1 Automatic wet pipe sprinkler systems:
  - .1 Standards: applicable NFPA standards.
- .2 Diesel fuel systems:
  - .1 Standards: applicable CAN/CSA B139 standards and requirements.

### 1.22 Other requirements during TAB

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.

## 2. **PART 2- PRODUCTS**

### 2.1 Not applicable

- .1 Not applicable

## 3. **PART 3 – EXECUTION**

### 3.1 Air systems to be verified and adjusted

- .1 Upon completion of generator replacement and modifications to associated cooling air ducts, perform the following checks and adjustments:
  - .1 VE-1 system (cool down)
    - .1 Check operation.
    - .2 Verify the operating conditions (air flow, operating pressures and sequence of operation of associated motorized dampers).
    - .3 Record and write the results of the readings in an air calibration report to provide for comments.
  - .2 Ventilation of the generator room
    - .1 Verify proper operation of controls and motorized dampers associated with generator cooling.
    - .2 Measure the operating conditions of the system (exhaust air flow (100% evacuation mode), fresh air flow (100% fresh air mode), differential pressure of the room versus the boiler room (adjacent room)).
    - .3 Record and write the results of the readings in an air calibration report to provide for comments.

### 3.2 Petroleum systems to be verified and adjusted

- .1 Upon completion of generator replacement and modifications to associated diesel fuel installations, perform the following checks and adjustments:
  - .1 Existing auxiliary tanks and pumping system
    - .1 Check operation.
    - .2 Collaborate with the generator manufacturer's technician to start and make the necessary adjustments for proper operation of the generator.
  - .2 Supervision and management fuel system
    - .1 Check operation.
    - .2 Adjust console programming and display for new leak sensors (probes) added to the system.
    - .3 Simulate leakage to different sensors (probes) to validate proper operation and identification on the panel.
    - .4 Record audit results in commissioning report for comments.

END OF THIS SECTION

## **1. PART 1 - GENERAL**

### **1.1 References**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM B 209M-02, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
  - .2 ASTM C 335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C 411-97, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C 449/C 449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C 547-00, Specification for Mineral Fiber Pipe Insulation.
  - .6 ASTM C 553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .7 ASTM C 612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .8 ASTM C 795-92, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
  - .9 ASTM C 921-92(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-M88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-01, Thermal Insulation Polyotrene, Boards and Pipe Covering.

### **1.2 Definitions**

- .1 For purposes of this section:
  - .1 "CONCEALED" - mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.
  - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
  - .1 CRF: Code Rectangular Finish.

### **1.3 Shop drawings**

- .1 Submit shop drawings as required.

## **2. PART 2 – PRODUCTS**

### **2.1 Fire and smoke rating**

- .1 In accordance with CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### **2.2 Insulation materials**

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24° C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612, with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

### **2.3 Jackets**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
  - .2 Lagging adhesive: compatible with insulation.

### **2.4 Accessories**

- .1 Vapour retarder lap adhesive:
    - .1 Water based, fire retardant type, compatible with insulation.
  - .2 Indoor Vapour Retarder Finish:
    - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
  - .4 ULC Listed Canvas Jacket:
    - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921 untreated.
  - .5 Outdoor Vapour Retarder Mastic:
    - .1 Vinyl emulsion type acrylic, compatible with insulation.
    - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
  - .6 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
  - .7 Contact adhesive: quick-setting
  - .8 Canvas adhesive: washable.
  - .9 Tie wire: 1.5 mm stainless steel.
  - .10 Banding: 19 mm wide, 0.5 mm thick galvanized.
  - .11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.
3. Fasteners: 4 mm diameter pins with 35 mm diameter square clips, length to suit thickness of insulation.

### **PART 3 – EXECUTION**

#### **3.1 Pre-installation requirements**

- .1 Pressure testing of ductwork systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

#### **3.2 Installation**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

#### **3.3 Ductwork insulation schedule – type, thickness and scope of work**

- .1 Insulate the exhaust air duct and associated plenum, including the sleeves of the motorized dampers.
  - .1 Type: TIAC code C-1, rigid fiberglass insulation for duct.
  - .2 Thickness: 50 mm.
- .2 Acceptable products: Microlite of Manville or approved equivalent of KNAUF or Fiberglass.
- .3 Finish: canvas jackets as per part 2.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 Product Data**

- .1 Submit shop drawings and product data required.
- .2 Design detailed control systems for specific operations. Refer to operation sequences in accordance with drawings and this section.
- .3 Shop drawings, product data for all control equipment and complete control diagrams must indicate rest position of equipment, model numbers, connection lines, operation sequences, set points, and adjusting ranges.

### **1.2 Automatic control works**

- .1 Scope of work
  - .1 Automatic control contractor shall be a subcontractor of the HVAC contractor.
  - .2 Provide materials and manpower as well as training and programming required for control works.
- .2 Dismantling
  - .1 Remove existing useless control accessories.
- .3 New setup
  - .1 Provide, install and connect all new (or to be relocated) electronic accessories to operate equipment according the sequence described on drawings (see diagram and details on drawings). Include all local controllers, I/O cards, relay, thermostats, probes, 120/24 VAC transformers, conduits and wiring cables required for complete work including interlocks and remote commands of motors at 120 Volts.
- .4 Materials
  - .1 All products from Delta Controls to be compatible with existing management network at CSA.
  - .2 See details for some control diagram items not be interpreted as connection diagram.
  - .3 All wiring to Quebec Electrical Code and NCB-2010. All apparent wiring in the generator room or other rooms to be installed in EMT conduits, and in Greenfield conduct for the last 600 mm connection to a motor or a mobile equipment.

## **2. PART 2 – PRODUCTS**

### **2.1 General**

- .1 Include all equipment and accessories required for operations and respect operation sequences.
- .2 Control to be of electric-electronic type.
- .3 In general, control wiring to be installed in conduit in accordance with Division 26.
- .4 Control equipment from same manufacturer-installer, unless otherwise indicated in drawings or in specifications.



### **3. PART 3 – EXECUTION**

#### **3.1 Installation**

- .1 Install all required control components in accordance with manufacturer's recommendations.
- .2 After installation, use, adjust and set all control elements and equipment installed in accordance with this section, to operate systems in accordance with operation sequences.

#### **3.2 Control sequences and building management**

- .1 See mechanical drawings for control diagrams and HVAC system sequences.
- .2 The monitoring of the following actions and functions have to be displayed on the screen of the nearest building management central controller located:
  - .1 Room temperature and set point for the generator room.
  - .2 Operation mode of the new VE-1 system (cool down) for the generator room.
  - .3 Operation mode for heating system interlock for the generator room.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 Specialized subcontractor**

- .1 Have the work of this section carried out by an oil contractor with a "Master Petroleum Installer" license. It will be under the responsibility of the general contractor.
- .2 Before the start of the work, provide proof of qualification of the contractor for this work.

### **1.2 References**

- .1 Execute pipeline construction in accordance with CSA / B139 series-15, as well as Bell-Mechanical design guidelines, and standby generator design guidelines.
- .2 Comply with one of the following standards for steel piping: API-5L, ASTM A53, CSA-Z245.1, ANSI-B31.3, API-1104, API-1107.

### **1.3 Submittals**

- .1 Submit data sheets as required
- .2 Identify the items referred to on the manufacturer documentation, ie; valves.

### **1.4 Maintenance sheets**

- .1 Provide the necessary maintenance sheets and attach them to the "Operation and maintenance manual".

## **2. PART 2 – PRODUCTS**

### **2.1 Piping**

- .1 Indoor and above-ground piping:
  - .1 Install 40-gauge, black-steel, oil-filled, vented, and oil-vented piping system when located in the generator room and near the fuel pumps.
- .2 Filling and vent piping :
  - .1 All fill pipe and aboveground vent pipe:
    - .1 Schedule 40 carbon steel with threaded joints. Fitting: Schedule 40 carbon steel with threaded joints.
- .3 Outdoor piping:
  - .1 All buried piping shall be double-skinned fiberglass and / or flexible conduit installed in tertiary conduit, ULC approved, "APT" brand, "Felxworks" from OPW or "enviroflex". All double-wall piping should extend inside the transition box just next to the entrance to the piping in the building as well as into the collector well on the main tank, and the joints should be visible and accessible.

DIAMETER	MAXIMUM OPERATING PRESSURE
19mm (3/4")	999 Kilopascals (145 lb/po <sup>2</sup> )
25mm (1")	861 Kilopascals (125 lb/po <sup>2</sup> )
38mm (1 1/2")	689 Kilopascals (100 lb/po <sup>2</sup> )
50mm (2")	517 Kilopascals (75 lb/po <sup>2</sup> )
75mm (3")	517 Kilopascals (75 lb/po <sup>2</sup> )

## 2.2 Seals

- .1 For screw fittings use G.F. Thompson Company's Master Metallic Compound. Mix the product well before laying. The use of Teflon tape is strictly forbidden.

## 2.3 Supports

- .1 Support piping with a "U" galvanized steel profile that must be supplied with all required hardware such as: floor or wall support, metal caps at ends, etc., all in accordance with the plan details.
- .2 In addition to these instructions, comply with all applicable requirements for fasteners and seismic devices required by the codes.

## 2.4 Painting

- .1 Paint all piping and support with one (1) coat of primer and two (2) coats of paint such as "Sico, Epoxy Flex" no. 631-995. Before applying the primer, clean the pipework with a degreaser. Follow the instructions and details of the plans for painting the pipework in the workshop.

## 2.5 Identification

- .1 Identify all installed piping. The direction of flow must also be indicated. The identification must be in French on yellow tape with black inscription.

## 2.6 Valve

- .1 Supply and install manual ball valves as shown on plans and sketches.

Accepted quality: Velan - Valvac (or equivalent), fig. S \_\_ M1113 SSGA with teflon seat (Viton fittings), stainless steel or bronze body, full-size handle and self-locking nut.

## 2.7 Check valve

- .1 Provide and install a check valve at the locations indicated on the drawing and sketch.

Accepted quality: Velan-Valvac fig. S \_\_ 3114B, with Teflon seat (Viton fittings), bronze body and stainless steel disc.

Ex .: At the pumps discharge, upstream of the valve on the generator fuel supply piping, where required.

## 2.8 Flexible hose

- .1 Note that the required hoses between the generator and the fuel line are supplied and installed by the Generator Manufacturer. All other flexible hoses will be such as "Everflex", "Fire-Shield" or equivalent (metal hoses).

## 2.9 Dimension of piping

- .1 Dimension the size of the fuel supply and return piping as shown on the drawings. This piping must be dimensioned based on the run to run, the suction capacity of the generator pump, and the Generator Manufacturer's standards.

## 2.10 Supply to the generator

- .1 Install generator supply and return piping as close as possible to generator stand so as not to interfere with circulation around the generator.
- .2 Complete fuel line connections to fittings on a transition plate integrated into the generator base by the manufacturer.

## 2.11 Maintenance and repair

- .1 Provide that, in order to allow the maintenance, repair and replacement of the various components installed on the generator's fuel distribution system, the Contractor must install all the unions necessary to allow the replacement of the network components.

## 2.12 Filters

- .1 The filters will be supplied and factory-fitted on the generator by the manufacturer.

## 2.13 Veeder-Root panel (existing)

- .1 The complete "Veeder-Root" fuel management and leak detection system model TLS-350 is existing.
  - .1 The new probes must be connected by conduit to the control panel (see electrical documents for wiring and conduits). The conduit / wiring between the tank and the control panel and the electrical connection of the control panel are the responsibility of the electrical contractor. The location of the control panel is indicated on the plans. The components of the detection system must be provided by the oil contractor. Add expansion modules to receive the communication of the new probes.
  - .2 Provide compatible remote communication card for IP link and integrate with existing console.
- .2 The system will also include liquid presence detection probes (as indicated in the plans) to detect leaks on the network or near certain components that are more at risk (eg pump system, auxiliary tank, etc.). These probes will be complete with support for proper installation.

## **PART 3 – EXECUTION**

### **2.14 Piping**

- .1 Install piping in accordance with CSA / B139 Series 15 and Manufacturer's recommendations.
- .2 Connect piping to equipment according to manufacturer's instructions.
- .3 Use eccentric reducers to connect pipes of different diameters to allow free discharge of liquid.
- .4 Provide sufficient clearance to allow access to equipment, valves and fittings for servicing
- .5 Trim pipe ends, remove slag and dirt, both indoors and outdoors.
- .6 Install the piping giving it a slope towards the tank.
- .7 Use eccentric gearboxes when required on piping.

### **2.15 Rinsing and cleaning**

- .1 Rinse piping system for at least 1 hour with shutdown every five minutes after pressure testing is complete. Clean the strainers and change the filters. Use for flushing the networks, diesel fuel # 2. Then dispose of the fuel used for rinsing the networks in accordance with the requirements of the environmental regulations and the recycling of these products.

### **2.16 Valves**

- .1 Install manual ball valves so that their handle is easily accessible and manoeuvrable.
- .2 Install valves at all locations indicated.

### **2.17 Suspension brackets and piping supports**

- .1 Fabricate hangers, brackets and bracing in accordance with ANSI B31.1 and MSS-SP58.
- .2 Subject to structural members. If there are no structural members or the anchor sleeves are not in the right place, suspend the brackets to "U" profiles or steel angles. Provide and install additional structural members. Have the prior approval of the Consultant.
- .3 Obtain permission before using vertical expansion anchors. Use at least two (2) sockets for each bracket or bracket. Fasten piping and equipment according to the manufacturer's recommendations
- .4 Acceptable product: Grinnell, Apex or Myatt:
  - .1 Copper piping: drains, vents and others: Grinnell CR 65, CT 121;
  - .2 All other services in general: Grinnell 105 up to 50 mm and 260 for 65 mm and over, and 261 for verticals;
  - .3 The nominal length of the suspension rods shall be 150 mm for all piping; and;
  - .4 The rods shall be of mild steel, with mechanical threading of sufficient length for the adjustment of the piping levels.
- .5 Suspension

Pipe dimension (diam.)	Diam. de la tige	Maximal spacing	
		Steel	Copper
20 – 25	10 mm	2.1 m	1.8 m
30	10 mm	2.1 m	1.8 m
40	10 mm	2.7 m	2.4 m
50	10 mm	3.0 m	2.7 m
65 – 75	10 mm	3.6 m	3.0 m

- .1 Place the support within 300 mm each of the horizontal elbows;
- .2 All supports must have at least the following three (3) parts: anchor sleeve, suspension rod, collar or caliper;
- .3 Suspension clamps in relation to anchorages shall be offset so that the rod is vertical when the piping is hot;
- .4 Do not use perforated iron strip, wire, chain or solid ring suspension devices. "CADDY" bearing rod fasteners will not be permitted; and
- .5 Do not drill pipes with suspension rods.
- .6 The piping in the generator set shall be installed on galvanized steel profile supports in accordance with the details and specifications of the plans.
- .7 In addition to these instructions, follow all applicable requirements for fasteners and seismic devices required by codes.

#### 2.18 Test and verification

- .1 Verification tests must be performed in the presence of a ministerial's representative. The Contractor is required to notify, at least 72 hours in advance, its intention to perform the tests. He will also have to notify the municipal and provincial authorities.
  - .1 Coordinate with ministerial's representative. to obtain the availability of the RBQ's authorized verifier to attend the tests and carry out the necessary inspections if required by the owner.
- .2 Check each connection with soapy water.
- .3 The piping shall be checked separately from the auxiliary tank at a pressure of between 350 Kpa (50 psi) and 700 Kpa (100 psi) for twenty-four (24) hours.
- .4 Measure pressure using a pressure gauge graduated in units of not more than 10 Kpa (1 psi).
- .5 Test tanks and piping when assembled to a pressure of between 30 Kpa (4 lbs / in) and 35 Kpa (5 lbs / in) for a minimum of four (4) hours.
- .6 A report of the test results must be sent to the ministerial's representative.
- .7 The certificate of conformity of work must be signed by a licensed petroleum equipment installer who must certify that the information pertaining to petroleum equipment is accurate and that the work, the verifications, the pressure testing and the surveys were conducted under his supervision.

END OF THIS SECTION

## 1. **PART 1 – GENERAL**

### 1.1 **References**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A 480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A 635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
  - .3 ASTM A 653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Agency Association (NFPA).
  - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-02, 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, 2nd Edition 1995 and Addendum No. 1, 1997.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
  - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

## 2. **PART 2 - PRODUCTS**

### 2.1 **Seal Classification**

- .1 The seal class of ducts has to be determined according the following table :

<u>Maximum Pressure Pa</u>	<u>SMACNA Seal Class</u>
500	B
250	B
125	B

- .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.
  - .3 Class C: transverse joints and connections made air tight with sealant, tape or combination thereof. Longitudinal seams unsealed.
  - .4 Unsealed seams and joints.

### 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.
  - .1 Acceptable products : Duro-Dyne S-2; Foster 30-02; 3M; EC-800.

### 2.3 Tape

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50mm wide.
  - .1 Acceptable product : Duro-Dyne FT-2.

### 2.4 Duct Leakage

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual for a Class B.
- .2 The exhaust plenum of the generator ventilation is equipped with a drain connection piped to the nearest drain. Bottom of the plenum to be sealed with appropriate product and ending at a minimum of 50mm from the bottom for all the plenum perimeter.

### 2.5 Fittings

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
  - .1 Rectangular: standard radius.
  - .2 Round: centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400mm: with single thickness turning vanes.
  - .2 Over 400mm: with double thickness turning vanes.
- .4 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .5 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

### 2.6 Fire Stopping

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Fire stopping material and installation must not distort duct.

### 2.7 Galvanized Steel Ducts

- .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
- .3 Joints: to ASHRAE, SMACNA, proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

### 2.8 Hangers and Supports

- .1 Hangers and Supports: in accordance with Section 230529E - 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 ASHRAE and SMACNA.
  - .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA and the following table :



<u>Duct Size (mm)</u>	<u>Angle Size (mm)</u>	<u>Rod Size (mm)</u>
Up to 750	25 x 25 x 3	6
751 to 1 050	40 x 40 x 3	6
1 051 to 1 500	40 x 40 x 3	10
1 501 to 2 100	50 x 50 x 3	10
2 101 and 2 400	50 x 50 x 3	10
2 401 and over	50 x 50 x 3	10

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

### 3. PART 3 - EXECUTION

#### 3.1 General

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE, SMACNA and as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE, SMACNA, as indicated.
- .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.

#### 3.2 Hangers

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

<u>Duct Size (mm)</u>	<u>Spacing</u>
To 1 500	3 000
1 501 and over	2 500

### 3.3 Watertight Duct

- .1 Provide watertight duct for:
  - .1 Exhaust air plenum for the generator.
  - .2 All indicated ducts.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Solder or weld joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards fume or gas hoods served.
  - .1 Slope header ducts down toward risers.
- .4 Fit base of riser with 150mm deep drain sump and 32mm drain connected, with deep seal trap and valve, trap primer and discharging to open funnel drain as indicated.

### 3.4 Sealing and Taping

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

### 3.5 Leakage Tests

- .1 Refer to Section 230593E – Testing, Adjusting and Balancing (TAB) of Mechanical Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30m long with not less than three branch takeoffs and two 90 degrees elbows.
- .7 Complete test before performance insulation or concealment Work.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 No object**

## **2. PART 2 - PRODUCTS**

### **2.1 Flexible connections**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material: neoprene
  - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated between 40°C to 90°C, with a density of 1.3 kg/m<sup>2</sup>.
  - .2 Acceptable products: Duro-Dyne or Dyn-Air.

### **2.2 Access doors in ducts**

- .1 General
  - .1 Non-insulated ducts
    - .1 Sandwich construction of same material as duct, non-insulated, one sheet metal thickness heavier, minimum 1.0mm thick complete with sheet metal angle frame.
  - .2 Insulated ducts
    - .1 Sandwich construction of same material as duct, insulated, although with 25mm thick rigid glass fiber insulation. The fiber shouldn't be exposed.
- .2 Gaskets: neoprene or rubber mousse.
- .3 Hardware:
  - .1 For door measuring up to 300 x 300mm: 2 sash locks
  - .2 For door measuring from 301 to 450 mm: 4 sash locks
  - .3 For door measuring from 451 to 1 000mm: piano hinge and minimum 2 sash locks
- .4 Acceptable products: Nailor, Cendrex, Trolec or approved equivalent

### **2.3 Operation dampers with multiple shutters (or motorized dampers)**

- .1 Of the type with blades opposed on modulating shutters, or parallel blades on on/off shutters.
- .2 Interrelated blade out of cast steel or extruded aluminum containing gaskets made out of extruded vinyl, stainless steel trimmings with spring, and a galvanized molded steel frame or from extruded aluminum.
- .3 Bronze bearings, self-lubricating, adjusted by pressure.
- .4 Clutch control: tie rods made from clad steel, brass pivots and clad steel supports, and containing a control rod out of plated steel.
- .5 Positioner: being appropriate for the damper.
- .6 Height of blades: 100mm maximum.
- .7 Required quality: T.A. Morrison series 1000; but T.A. Morrison insulated series 9000 (for fresh air and exhaust air), or equivalent from Trolec or Penn.

## 2.4 Fire dampers

- .1 Approved fire damper and carrying a UL or ULC label, and fulfilling the requirements of the Canadian Fire Commissioner (CIC).
- .2 Fire dampers assembled on hinge on the higher part, with simple eccentric shutters, round or square, of the type with articulated or coupled blades, by rolling up or guillotine. Dimensions of the unit calculated so as not to restrict the section of the duct.
- .3 Dampers actuated by fusible link, with counterweight allowing closing and locking in the closed position once the mechanism is activated, or with complete on control with control spring for the type with several shutters, or rolling up assembled in horizontal position in a vertical ventilation duct.
- .4 The complete unit with steel frame and angles of 40 x 40 x 3mm on all it's circumference, on the two sides of the partition of the crossed fire wall.
- .5 Required quality: Nailor Industry or equivalent from Controlled Air Manufacturing ltd., Ruskin (Kerr-Haut), E.H. Price.  
Type A dampers (100% free area) for the duct having a maximum height of 300mm, of the type B for greater heights.

## 2.5 Fittings for testing instruments

- .1 Requires quality: Duro-Dyne IP-2 model.

# 3. PART 3 – EXECUTION

## 3.1 Flexible connections

- .1 Install in following locations:
  - .1 Inlets of blowers.
  - .2 Outlets of blowers.
  - .3 Inlets and outlets of exhaust and return air fans.
- .2 Length of connection: 150mm.
- .3 Minimum distance between metal parts when system is in operation: 75mm.
- .4 Install in accordance with SMACNA recommendations.

## 3.2 Tape and sealing material

- .1 Apply the sealing material in accordance to the SMACNA recommendations and of that of the manufacturer.
- .2 Bathe the tape in the sealing material, than apply at least one coating in accordance to the manufacturers recommendations.

## 3.3 Access doors

- .1 Dimensions:
  - .1 According to the indications listed in section 230500E.
- .2 Location:
  - .1 At the required locations in order to permit the access to the fire and smoke dampers.
  - .2 At the required locations in order to permit the access to the air flow control.
  - .3 At the required locations in order to permit the access to the necessary devices requiring a periodical maintenance.

.4 At the required locations in accordance to the standards.

### 3.4 Fittings for instrument test ports

#### .1 General

- .1 For the flow readings, install in accordance with the SMACNA recommendations.
- .2 For the temperature readings, install in accordance with the SMACNA recommendations.
- .3 Install the fittings in accordance with manufacturer's instructions.

#### .2 Locations:

- .1 For air flow readings:
  - .1 At ducted inlets to roof or wall exhausters.
  - .2 At inlets or outlets of other fan systems.
  - .3 At main and sub-main ducts.

### 3.5 Fire dampers

#### .1 Install in accordance with the SMACNA, NFPA recommendations.

#### .2 Fire dampers and shutters:

- .1 Install the fire dampers in accordance to the NFPA 90A-2002 standard and «SMACNA fire, Smoke and radiation damper installation guide for HVAC systems», 4<sup>th</sup> edition 1992.
- .2 Complete work without reducing the degree of fire resistance of the wall or partition firebreak.
- .3 If necessary, approve the achieved work prior to dissimulating parts of them.
- .4 Get approve a standard installation.

#### .3 Adjusting and balancing dampers:

##### .1 Balancing dampers:

- .1 The contractor will have to supply and install all the necessary balancing registers in order to allow the calibration of the ventilation/air-conditioning systems, and this, even if these dampersall are not shown with the drawings.
- .2 Install dampers in accordance with SMACNA.
- .3 Caulk and seal joints between multiple registers with a UL approved transparent silicone based sealer.

END OF THIS SECTION

## **1. PART 1 – GENERAL**

### **1.1 Shop drawings and Data Sheets**

- .1 Submit shop drawings and data sheets required.

## **2. PART 2 – PRODUCTS**

### **2.1 2.1 Piping**

- .1 Install stainless steel exhaust pipe, schedule 10-S (wall 3.0 mm), 304L, welded joints and long radius elbow, all in accordance with ASTM A774, ASTM A778 and ASTM A409.

### **2.2 2.2 Welding**

- .1 Perform welding in accordance with the latest edition of the specifications of the Government of Canada and the province of Quebec applicable to this work.
- .2 Perform welding work by licensed welder only.

### **2.3 2.3 Dilation of exhaust piping**

- .1 Install on the exhaust piping:
  - .1 Expansion joints and anchorages, as indicated on the drawings;
  - .2 Anchors welded to the exhaust piping and anchored to the ceiling. These anchors will be located as close as possible to the silencer to prevent it from moving. In addition, locate an expansion / compression joint as indicated on the drawings
  - .3 Pipe supports / guides shall be of appropriate quality and characteristics for the piping it supports. Make sure that the inside diameter of the support / guide perfectly matches the outside diameter of the exhaust pipe.

### **2.4 2.4 Thermal insulation and lining**

- .1 Heat insulation of all modified piping and cover aluminum liner insulation
- .2 The installation shall be in accordance with the existing installation that is retained
- .3 Insulation materials are:
  - .1 Exhaust Insulation: High temperature resistant ceramic fiber such as Cerwool-2300 mattress 50mm thick. Install a total of 100mm thickness overlapping the joints. Hold the insulation in place with stainless steel straps of appropriate size and size for the installation diameters
  - .2 Exhaust Drain Insulation: High temperature resistant ceramic fiber such as Cerwool-2300 in 50mm thick mat. Install a total of 50mm thick. Hold the insulation in place with stainless steel straps of appropriate size and size for the installation diameters
  - .3 Liners: Textured finish aluminum jacket with pre-molded elbow fittings and piping and fittings. Hold the liner in place with stainless steel straps. Seal all joints of the liner with an aluminum-colored sealant.

### 3. PART 3 – EXECUTION

#### 3.1 Installation – Clearance

- .1 Install exhaust piping, keeping free space as much as possible.
- .2 Provide unions required for hose replacement.

#### 3.2 Installation – silencer

- .1 Supply and install the exhaust silencer described in the plans.

#### 3.3 Drainage piping

- .1 Supply and install silencer drainage piping. This piping must:
  - .1 Black steel, Series 40, with screwed joints;
  - .2 Have a minimum dimension of 25 mm diam;
  - .3 Be equipped with a flexible joint;
  - .4 Slope towards the wall and descend 300 mm from the finished floor;
  - .5 Supply and install a ball valve on this drain pipe. Installation height at 1200 mm from the finished floor;
  - .6 Suspend from the ceiling and anchor this drainage pipe to the wall;
  - .7 Insulate this pipe as silencer and exhaust pipe as described in section 2.4 of this section;
  - .8 Identify this piping; and
  - .9 Provide space and equipment required for expansion of this pipe.

#### 3.4 Suspension brackets and piping supports

- .1 Fabricate hangers, brackets and bracing in accordance with ANSI B31.1 and MSS-SP58.
- .2 Subject to structural members. If there are no structural members or the anchor sleeves are not in the right place, suspend the brackets to "U" profiles or steel angles. Provide and install additional structural members. Have the prior approval of the Consultant. Refer to the documents of the Structural Engineer.
- .3 Obtain permission before using vertical expansion anchors. Use at least two (2) sockets for each bracket or bracket. Fasten piping and equipment according to the manufacturer's recommendations.
- .4 Suspension
  - .1 Comply with the details and specifications of structural plans and specifications.
- .5 In addition to these instructions, follow all applicable requirements for fasteners and seismic devices required by the codes

#### 3.5 Testing

- .1 Perform leak tests on the exhaust system. These tests will be:
  - .1 Fitted at 20,7 kPa (84" w.g. (3 psig) air pressure over a period of three (3) hours;
  - .2 Performed before installing insulation;
  - .3 Facts in the presence of ministerial's representative; and
  - .4 Made by an accredited company.

Note: Conduct a pressure resistance test on the exhaust silencer independently of the system

- before installation and connection. Correct any leaks to the satisfaction of the ministerial's representative.
- .2 Take resistance reading in inches of water from exhaust during GE tests. This reading must be taken by the manufacturer. Provide a test report.
  - .3 A report of the test results must be sent to the ministerial's representative.

END OF THIS SECTION



### 3.4 Suspension brackets and piping supports

- .1 Fabricate hangers, brackets and bracing in accordance with ANSI B31.1 and MSS-SP58.
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### 3.5 Testing

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    - .3 Facts in the presence of ministerial's representative; and
    - .4 Made by an accredited company.
- Note: Conduct a pressure resistance test on the exhaust silencer independently of the system before installation and connection. Correct any leaks to the satisfaction of the ministerial's representative.
- .2 Take resistance reading in inches of water from exhaust during GE tests. This reading must be taken by the manufacturer. Provide a test report.
  - .3 A report of the test results must be sent to the ministerial's representative.

## **Division 21**

Fire protection

## **Division 23**

Heating, ventilation and air conditioning (HVAC)