

PART 1 - GENERAL

- 1.1 General Conditions .1 This section shall apply to and govern all sections of Division 15.
- 1.2 Scope .1 The Contractor shall supply all labour, materials, equipment and services required for complete safe installation of mechanical work in accordance with the intent of this specification and as shown on the drawings.
- 1.3 Cost Breakdown .1 Upon notice of contract award, and as requested by the Contract Administrator, furnish a detailed price breakdown of tendered price to facilitate evaluation of progress payments.
- 1.4 Scope of Work .1 Work to be included by this Division includes the completion of the following work items including all related work.
- .1 Removal of existing pneumatic ventilation damper operators and any remaining pneumatic air tubing. Installation of new electric damper operators.
  - .2 Removal of the existing engine exhaust system.
  - .3 Disconnect all piping connection to the existing generator to facilitate removal.
  - .4 Installation of new combustion air intake ductwork.
  - .5 Rework of the natural gas fuel supply to accommodate the new generator set including all changes required by the utility to facilitate the new increased load and other current standards.
  - .6 Rework of the potable water supply system to accommodate the new generator.
  - .7 Installation of new generator engine exhaust system including new silencer and flexible engine connection.
  - .8 Installation of a new natural gas detection and alarm system.
- 1.5 Work of Other Trades .1 Cooperate and coordinate the Work specified in this section with the requirements of other units of Work specified in other sections.
- .2 The Contractor shall rough in for and/or connect up all equipment requiring mechanical services, as shown on drawings or noted elsewhere in the Specifications.
  - .3 Supply other trades with all necessary details, roughing-in drawings, wiring diagrams, etc. as required.

- 
- .4 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate Work with all trades and make changes to facilitate a satisfactory installation. Make no deviations, without prior approval of the Contract Administrator.
- 1.6 Documents
- .1 Examine all drawings, specifications, including those of other sections, Instructions to Bidders, General Conditions of Contract and Special Requirements for information affecting this section.
- .2 Where drawings show installation of piping, ductwork, and equipment diagrammatically, install equipment and services with due regard to details of building structure and services provided by other trades, as well as maintaining maximum accessibility and use of space.
- 1.7 Intent
- .1 Work shall be in accordance with the Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or called for, and ready for operation before acceptance.
- .2 Where contradictions in specifications and drawings are implied obtain ruling from the Contract Administrator. Where ruling is not obtained, include the item or arrangement of better quality, greater quantity, or higher cost in bid price.
- 1.8 Related Work Specified Elsewhere
- .1 Work Excluded from Mechanical Division
- .1 Concrete pits, pads and bases - see Section 03300 (antivibration pads, by section requiring same).
- .2 Electric wiring and connections - see Division 16.
- 1.9 Site Examination
- .1 Visit the site before Bidding and examine all local and existing conditions on which the work is dependent.
- .2 No consideration will be granted for any misunderstanding of work to be done resulting from failure to visit the site.
- .3 Provide for avoidance of damage and interference to existing work and rectify any damage due to work by this section.
- .4 Disconnect any existing equipment indicated to be re-used, rough-in in new position, and connect up ready for use. Removal and relocation of mechanical equipment by relevant Mechanical sections.

1.10 Regulatory Agencies

- .1 Promptly advise the Contract Administrator of any specified equipment, material, or installation of same which appears inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; of any necessary items of work omitted from the Contract Documents, or any discrepancies in the Specification.
- .2 Make timely application for all permits and certificates necessary to carry out the work. Supply and submit all drawings, application forms and fees payable to the relevant authorities.
- .3 On completion of the Work, submit, certificate of acceptance from inspection authorities to the Contract Administrator.
- .4 Make reasonable changes and alterations required by inspection authority without additional cost.

1.11 Scaffolding, Rigging and Hoisting

- .1 Provide scaffolding, rigging, hoisting and related installation services for work under this Division, except where otherwise specified. The scaffolding, rigging and hoisting provided shall meet the regulations of the Construction Safety Code.

1.12 Standards

- .1 Within the text of these specifications, reference is made to the following standards:
  - SAE - Society of Automotive Engineers
  - ASTM - American Society of Testing Materials
  - CSA - Canadian Standards Association
  - ASME - American Society of Mechanical Engineers
  - ANSI - American National Standards Institute
  - ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
  - SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
  - CGA - Canadian Gas Association.
  - ULC - Underwriters' Laboratories of Canada.
  - EEMAC - Electrical Equipment Manufacturers' Association of Canada.

- .2 Materials to carry CSA approval and to conform with applicable standards.

### 1.13 Definitions

Unless specifically indicated or noted otherwise, the following words, used in this specification or on related drawings, shall have the following meanings:

- .1 "Similar" or "equal". Equal in kind, materials, weight design and efficiency of performance and approved by the Contract Administrator as such in accordance with B6.
- .2 "Furnish" or "provide". To supply, install and connect up complete and ready for safe and regular operation.
- .3 "Install". To erect, mount and connect up complete with all related accessories necessary or required for safe and regular operation.
- .4 "Supply". To purchase, procure, acquire, deliver complete with all related accessories necessary or required.
- .5 "Indicated" or "shown". As indicated or shown on the drawings.
- .6 "Noted". As indicated or shown on the drawings.
- .7 "Detailed". As indicated or shown on drawings.

### 1.14 Inspection

- .1 The Contract Administrator is required to complete periodic or specific visits to the site to observe work in progress. When specific or milestone visits are identified by the Contract Administrator as necessary, provide 48 hours notice or when the milestones are expected to be met.

### 1.15 Shop Drawings

- .1 Submit shop drawings in accordance with General Requirements of CW 1110.
- .2 Prior to submitting shop drawings for the Contract Administrator's review, the Contractor shall review all shop drawings to confirm their meeting all requirements of the project, and mark and sign his approval on the drawings.
- .3 Each shop drawing must be certified by the manufacturer and, as such, shall indicate that all product engineering has been performed to ensure that product will meet the requirements of the intended installation.

- 
- .4 Include all electrical wiring diagrams and installation drawings for electrically powered equipment.
- 1.16 Record Drawings
- .1 Record drawings to show all field modifications.
- .2 Obtain a separate set of drawings and mark all as-built information as work progresses. Show inverts of all underground services.
- 1.17 Workmanship
- .1 Workmanship shall be in accordance with well established practice and standards of the trade.
- .2 The Contract Administrator shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance.
- .3 Employ only tradesmen holding valid Provincial Trade Qualification certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Contract Administrator.
- 1.18 Protection of Work
- 1 Protect equipment and material stored or in place during construction from weather, moisture, dust and physical damage.
- .2 Any equipment that has operating parts, bearings or machined surfaces that show signs of rusting, pitting or physical damage will be rejected.
- .3 Refinish damaged or marred factory finishes to the satisfaction of the Contract Administrator.
- 1.19 Design Authority's Approval
- .1 It is not incumbent upon the Contract Administrator to superintend the Work so as to relieve the Contractor of any responsibility.
- .2 Permission to proceed does not constitute approval of the Work, or portion thereof.
- .3 Approval of the Work shall be made only upon the successful conclusion of tests and satisfactory performance under design operating conditions
- 1.20 Operating and Maintenance Instruction to City Personnel
- .1 Instruct the representative designated by the City on the system operating and maintenance procedures, using the assistance of specialist subtrades and manufacturer's representatives, and provide manufacturer's explanatory literature. If proper instructions are not provided, in the Contract Administrator's opinion, instructions shall be provided or arranged and the costs involved shall be charged to the relevant section.
- .2 Deliver to the Contract Administrator prior to the scheduled

takeover date, three (3) sets of all brochures and literature supplied by the manufacturers of each piece of equipment, bound into hardback binders with suitable identification on the cover. Information shall include, but not be limited to, the following:

- Complete list of all contractors with addresses and phone numbers.
- Complete list of mechanical equipment supplied and installed under each section, including description, make, type, size, capacity, serial number and list of repair and replacement parts, with names and addresses of suppliers.
- Correct installation procedure.
- Illustrated parts list for all equipment.
- Manufacturer's recommended operating and maintenance instructions.
- Final corrected shop drawings for all equipment.
- Separate lubrication schedule, including each piece of equipment and showing frequency of service and grade of oil or grease required. This schedule shall be inserted at the front of the manuals.

1.21 Temporary Use of Equipment

- .1 No portion of any mechanical system or equipment provided under Mechanical Sections may be used for temporary purposes.

1.22 Supports, Bases and Pits

- .1 Supply and erect all special structural work required for installation of mechanical apparatus.

1.23 Identification

- .1 Ensure that equipment name plates, showing size, name of equipment, serial number and all other information usually provided, including name and address of manufacturer, are not painted over or removed, and where apparatus is insulated, provide adequate viewing openings.

1.24 Guarantees

- .1 Refer to General Requirements and General Conditions.

1.25 Installation and Erection

- .1 Information involving dimensions of building shall be taken from the appropriate drawings, and checked by site measurement. Refer to drawings of appropriate section for accurate information.
- .2 Drawings show general location and route to be followed by pipes, ducts, etc. Make necessary changes or additions

- to runs to accommodate site conditions. Location of pipes, ducts and other equipment shall be altered without charge, provided change is made before installation, and does not necessitate change in quantity of materials.
- .3 Install all piping and ductwork parallel to building walls and ceilings unless otherwise indicated.
  - .4 Install all piping and ductwork to conserve headroom and for minimum interference to free use of space through which they pass. Consideration must also be given to accessibility for service and maintenance.
  - .5 Check all levels shown before commencement of work to ensure adequate falls for graded pipes and report discrepancies immediately. Failure to so check and report does not relieve this section from responsibility for consequent extra expenditures.
  - .6 Before installation of fittings and equipment, consult detail drawings or obtain instructions for each location where details are not available.
  - .7 Secure approval prior to cutting holes. Employ section whose work is involved, cut openings no larger than necessary and without damage to adjoining work, and provide for repair of all damage to match adjacent work. This Contractor is responsible for all required cutting and patching relating to work in this Division, unless specifically noted otherwise.
  - .8 Prior to the cutting of any openings in walls, ensure that the wall does not serve a load bearing function. All openings in load bearing walls and other structural members shall be approved by the Contract Administrator.
  - .9 Provide and set bolts, templates, sleeves and fixing materials for fastening work under this section securely to work provided under other sections, in advance of other work, where required.
  - .10 Locate all openings in walls, partitions, beams, etc. required for installation of ducts, pipes and equipment, etc. specified in this Division of the specifications, and frame all openings as required.
  - .11 Pack free area between ducts or pipes and openings or sleeves with fireproof self-supporting insulation material subject to Contract Administrator's approval, and in accordance with requirements of authority having jurisdiction to maintain required fire rating of wall or floor assemblies.
  - .12 All sleeves other than those noted above, shall be caulked

between pipes and floor sleeves or openings to prevent seepage. Caulking compound and method of application shall be to the Contract Administrator's approval.

- .13 Protect equipment and systems from entry of dirt, dust, and other foreign material with fittings or covers appropriate to the system.

END OF SECTION 15010



PART 1 – GENERAL

1.1 General Conditions .1 General Conditions 15010 shall be part of this section.

PART 2 - PRODUCTS

2.1 Equipment .1 Manufacturer's nameplates:

- .1 A metal nameplate shall be applied to each piece of equipment at the factory, mechanically fastened with raised or recessed letters. Self adhesive metallic sheet labels are unacceptable
- .2 Provide Underwriters' Laboratories and/or CSA registration plates, as required by respective agency.
- .3 Manufacturers nameplate shall indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.
- .4 Locate nameplates so that they are easily read. Do not insulate or paint over nameplates.

2.2 Piping .1 Identify medium in piping by basic colour and with markers showing name and service including temperature, pressure and directional flow arrows.

.2 Apply primary colours and secondary colour bands on finished piping surfaces, in exposed areas only to indicate type and degree of hazard.

.3 Use existing coding system for building additions and alterations.

.4 Colour Schedule:

The following colours shall be as close as possible to Northern Paint Industrial Coatings colours listed below:

<u>Colour</u>	<u>Northern Paint Colour No..</u>
Blue	409
Light Blue	412
Green	368
Light Green	361
Yellow	352
Light Yellow	347

---

Red	313
Orange	329
Purple	303
Black	NR
White	NR

.5 Manufactured pipe markers and colour bands:

- .1 Pipe markers shall be plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for continuous operating temperature of 150°C. Apply to prepared surfaces.
- .2 50 mm wide tape single wrap around pipe or pipe covering with ends overlapping one pipe diameter but not less than 25 mm for colour bands.
- .3 Block capital letters 50 mm high for pipes of 75 mm nominal and larger and (including insulation) and not less than 20 mm high for smaller diameters.
- .4 Direction arrows 150 mm long by 50 mm wide for piping of 75 mm nominal or larger and including insulation and 100 mm long by 20 mm wide for smaller diameters. Use double headed arrows where direction of flow is reversible.
- .5 Waterproof and heat resistant plastic marker tags for pipes and tubing 20 mm nominal and smaller.
- .6 Black pipe marker letters and direction arrows, white on red background for fire protection pipe markers.
- .7 Acceptable product: Tuff Cote by Stranco.
- .8 Where colours differ submit legends with colour classifications to the Contract Administrator for review before ordering material.
- .9 Secondary Marking:
  - .1 Locate markers and secondary colour bands on pipe systems so they can be seen from floor or platform.
  - .2 On all piping runs at least once in each room.
  - .3 At maximum 15 m (49 ft.) spacing in open areas.

- .4 Both sides where piping passes through walls, partitions and floors.
- .5 At point of entry and leaving, where piping is concealed in pipe chase or other confined space, and at each access opening.
- .6 At start and end points of runs and at each piece of equipment.
- .7 At major manual and automatic valves immediately upstream of valves.
- .8 Identify branch, equipment or building served after valve.
- .10 Table: pipe and valve identification.

PIPE MARKER	VALVE TAG	PRIMARY	SECONDARY
<u>LEGEND</u>	<u>LEGEND</u>	<u>COLOUR</u>	<u>COLOUR</u>
Cold water	C.W.	Green	None
Engine exhaust	E.E.	Yellow	Black
Natural gas	N.G.	Yellow	Orange

2.3 Ductwork

- .1 Use 50mm (2") high black stencilled letters, eg. "Cold", "Hot", "Return", "Sanitary Exhaust", "Kitchen Exhaust" with directional flow arrow.
- .2 Maintain maximum 15m (50 ft.) distance between markings.
- .3 Identify ducts each side of dividing walls or partitions and beside each access door.
- .4 Stencil over final finish only.

2.4 Valves and Controllers

- .1 Provide 38mm (1 1/2") diameter 18 gauge brass tags with 12mm (1/2") stamped code lettering and numbers filled with black paint, secured with non-ferrous chains or "S" hooks for valves and operable controllers, except at plumbing fixtures and radiation.
- .2 Provide six identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.

- .3 Install where directed one copy of flow diagram and valve schedule mounted in glazed frame. Provide one copy in each operating and maintenance instruction manual.
- .4 Consecutively number valves in systems and where applicable valves shall be numbered as extensions of existing valve schedules.

END OF SECTION 15020

PART 1 - GENERAL

- 1.1 General Conditions .1 Mechanical General Conditions 15010 shall be part of this section.
- 1.2 Work Included .1 The work described in this section includes testing work for the following systems:
- .1 Plumbing and drainage.
  - .2 Potable water supply.
  - .3 Natural gas piping.

- PART 2 - PRODUCTS .1 Omitted.

PART 3 - EXECUTION

- 3.1 Test Requirements
- .1 Plumbing and drainage shall be tested in full conformance with the requirements of the Building Code of Canada (Plumbing), and as required by local inspection authority.
  - .2 Test potable water and plant water piping to a pressure of 350 kPa (51 psi) over the expected working pressure. Test to be completed with air over water and maintained over 6 hours with no loss.
  - .3 Test natural gas piping according to CSA Code B 149.
- 3.2 Procedures
- .1 The testing of the individual systems shall be completed by the trade responsible for installing the system.
  - .2 Provide all necessary equipment and perform all work required to field test all piping systems, including all remedial and re-testing work.
  - .3 Clean all piping systems by flushing with water or blowing with air with all valves wide open prior to testing and before installing any primary element instrumentation on the piping systems.
  - .4 Timely notification shall be given to the Contract Administrator of the schedule for all tests. A minimum of three working days is required to schedule witnessing of tests.
  - .5 All piping must pass all field tests in the presence of the Contract Administrator.
  - .6 Completion of tests is not evidence of acceptance of tested part of contract.

- .7 No claim for damage will be made for injury or breakage of parts due to tests.
- .8 Piping, which has to be concealed prior to the completion of the service as a whole, shall be tested in sections to the pressures and for the periods specified, prior to the piping being concealed.
- .9 **No insulation shall be applied until testing has been completed.**

END OF SECTION 15060

---

PART 1 -GENERAL

- 1.1 General Conditions .1 General Conditions 15010 shall be part of this section.
- 1.2 Work Included .1 Work under this section shall include, but not necessarily be limited to insulation covering of the following:
- Engine exhaust piping system.
  - Combustion air ductwork.
- 1.3 Related Work Specified Elsewhere .1 Insulation lining of manufactured air handling equipment is specified in the Air Distribution Section 15800.
- .2 Testing Section 15060
- Plumbing Section 15400
- Air distribution Section 15800
- 1.4 Qualifications .1 Insulation shall be installed by qualified workmen who are fully familiar with the insulation manufacturer's installation recommendations.

PART 2 -PRODUCTS

- 2.1 Insulation .1 Ductwork
- .1 Combustion air ductwork shall be insulated with 50 mm (2") thick fibreglass type RFFRK rigid duct insulation.
- .2 Piping
- .1 Engine exhaust piping shall be insulated with 50 mm (2") moulded hydrous calcium silicate high temperature pipe insulation. Insulation shall have an aluminium jacket held in place with stainless steel snap straps. Insulation shall be Fiberglas Kaylo 10 with metal jacket installed as per manufacturer's instructions.
- 2.2 Jacketing and Covering .1 Exposed fibreglass pipe and duct insulation shall be finished with a (6 ounce) fire retardant canvas jacket, adhered and finished with Benjamin Foster 30-36 or Bakelite 120-09 lagging adhesive.
- .2 All lap joints of vapour barrier jacketed insulation shall be sealed with a brush coat of Bakelite 230-06 or 230-09 non-combustible vapour sealant.

---

**PART 3 - EXECUTION**

**3.1 Application**

- .1 **Pipe insulation shall not be applied until the specified testing has been carried out to the satisfaction of the Contract Administrator.**
- .2 Piping and ductwork insulation shall be applied and finished in accordance with the manufacturer's recommendations.
- .3 Any paste used for the finish applications shall be of a non-mildewing type.
- .4 No exterior duct insulation is required where ducts are acoustically lined.
- .5 Duct sizes indicated are inside dimensions. The external dimensions of lined ductwork shall be increased by the thickness of the lining.
- .6 Insulation shall be applied over clean dry and oil free surfaces.
- .7 Insulation shall be applied so that the finished application has the full specified thickness or insulation. **Flexible duct insulation is not acceptable.**
- .8 Rigid and board style insulation shall be impaled on No. 9 insulation pins at 300 mm (12") on centre and secured with 50 mm (2") diameter speed washers. Insulation shall be layered with joints and cut ends staggered and painted with insulation cement.
- .9 Insulation specified for piping shall be applied to the entire system including flanges, valves, elbows and all other appurtenances.
- .10 Insulate fittings and elbows with formed rigid insulation sections. **Flexible insulation is not acceptable.**

**3.2 Jacketing**

- .1 All fibreglass piping and ductwork insulation shall be finished with 6 ounce canvas and two coats of adhesive to form a fire retardant jacket.

**3.3 Sealing**

- .1 Seal all cold pipe insulation with all service jacket along the longitudinal laps with vapour barrier adhesive. Also adhere 73 mm (3") wide butt strips smoothly and securely over all end joints with the vapour barrier adhesive to ensure continuous vapour barrier.

Vapour barrier adhesive shall be Benjamin Foster 30-36 or Bakelite 120-09.



- .2 Seal all exposed edges and cut ends of fibreglass duct liner and cover all retaining pins with two brush coats of Bituminous Sealant.

END OF SECTION 15180

**PART 1 - GENERAL**

**1.1 General Conditions** .1 Mechanical General Conditions 15010 shall be part of this section.

**1.2 Work Included** .1 Work includes the following piping systems:  
- Potable water supply  
- Drainage and vents  
- Engine Exhaust  
- Natural Gas

**1.3 Related Work Specified Elsewhere**

Testing	Section 15060
Insulation	Section 15180
Plumbing	Section 15400

**PART 2 - PRODUCTS**

**2.1 Pipe Material Schedule**

<u>System</u>	<u>Type</u>
Potable Water - Interior	1
Sanitary Drainage & Vent - Interior	2
Natural Gas	3
Engine Exhaust	3

**2.2 Piping Specifications**

	<b>SERVICE</b>	<b>PRODUCT</b>
Type 1	above ground 65 mm (2 1/2") and smaller	Type L hard copper
	Above ground 75 mm (3") and larger	Galvanized steel, Schedule 40, ASTM-A120
Type 2	above ground 50 mm (2") & under	Copper DWV tubing
	above ground 75 mm (2 1/2") & over	Cast Iron Class 4000
	underground inside building all sizes	Cast Iron Class 4000 or PVC - DWV

Type 3

above ground inside building - all sizes Black steel, Schedule 40, ASTM-A-53, screwed (CSA Standard) joints for sizes 50 mm (2") and less, 65 mm (2 1/2") and larger shall be welded.

2.3 Valves

- .1 All valves shall conform to the requirements of ANSI, ASTM and applicable MSS standards.
- .2 As much as is possible, all the valves shall be from the same manufacturer.
- .3 Valve body shall be marked to show manufacturer's name and pressure rating.
- .4 Valve construction shall conform to relevant industry standards published by Manufacture Standards Society according to (MSS-SP-25).
- .5 Valve Application Schedule:

Potable Water	Shut off	1.1, 1.4
	Check	3.1, 3.4, 3.5
	Drain	6.2
Natural Gas	Shut off	7.1, 7.2

		Style	Size	Figure & Spec	Pressure (on Steam)
Type	1.1	Gate	50 mm (2") & smaller	TOYO Fig 293 - Bronze rising stem - screwed	862 kPa 125 psi
	.2	Gate	50 mm (2") & smaller	TOYO Fig 298 - Bronze rising stem - screwed	1034 kPa 150 psi
	.3	Gate	50 mm (2") & smaller	VOGT 12111 - Forged Steel, bolted bonnet - HFS - screwed	
	.4	Gate	63 mm (2 1/2") & larger	Fig. 421A - Cast iron, bronze trim OS & Y flanged	862 kPa 125 psi
	.5	Gate	63 mm (2 1/2") & larger	KITZ 300 SCLS - cast steel bolted bonnet - HFS - flanged	2068 kPa 300 psi
Type	3.1	Check	50 mm (2") & smaller	TOYO Fig 236 - bronze body swing check - screwed	862 kPa 125 psi

	.4	Check	63 mm (2 1/2") & larger	TOYO Fig 435A - cast iron swing check - flanged	862 kPa 125 psi
	.5	Check	63 mm (2 1/2") & larger	Moygrove Fig W12A-I6V-I- cast iron Wafer check Viton Seat Material	862 kPa 125 psi
Type	4.1	Ball	50 mm (2") & smaller	TOYO Fig 5044A - brass body - ball valve with balance plate - brass ball - screwed	1034 kPa 150 psi
	.2	Butterfly	63 mm (2 1/2") to 75 mm (3")	Bray Series 30 wafer style Cast Iron body (CRN numbered), nylon coated ductile disc, 304 shaft, EPDM seat - lever operator	1379 kPa 200 psi Non-steam
Type	6.1	Drain	20 mm (3/4")	TOYO Fig 5046 - bronze ball c/w cap & chain	1034 kPa 150 psi
	.2		12 mm (1/2")	Cambridge 32 W 200	
Type	7.1	Ball	50 mm (2") & smaller	KITZ Fig 68	
	.2	Plug	63 mm (2 1/2") & larger	Nordstrom Fig 115 semi steel-wrench	

- .6 Butterfly valves may be substituted for gate valves on shut-off service in potable water systems.
- .7 Automatic natural gas shutoff valves shall be Maxon Series 5000, normally closed, electrically actuated, automatic reset, rising stem valve sanctioned for natural gas shut-off service. Valve body shall be cast iron with Trim 1-1.

2.4 Pipe Fittings

<u>Pipe Product</u>	<u>Fitting</u>
Hard copper piping	Solder joint cast brass or wrought copper
Galvanized steel	Malleable iron, 1034 kPa (150 lb.) standards, screwed, galvanized
Copper tube	Solder joint, cast brass, or wrought copper
Cast iron Class 4000	Mechanical joint or bell and spigot
PVC sewer pipe	Gasketed joint PVC fittings to ASTM 3034
Black steel	Malleable iron or steel (CSA B-149.1)

2.5 Pipe Hangers

- .1 Lower attachment - (Grinnell ref. numbers unless otherwise noted).

	<u>Pipe Material</u>	<u>Pipe Size</u>	<u>Hanger</u>
	All piping other than copper (bare pipe)	up to 50 mm (2") 65 mm (2-1/2") & over	Fig. 65 Fig. 260
	All piping other than copper (insulated) (2-1/2") & over	up to 50 mm (2") 65 mm (2-1/2") & over	Fig. 65 with Fig. 160 (or to match insulation) Fig. 260 with Fig. 161 (or to match insulation)
	Copper	all sizes	Fig. CT65
.2	Intermediate attachment		Fig. 140 threaded rod or Fig. 248 eye rod.
.3	Upper Attachment:		
	<u>Structure</u>		<u>Attachment</u>
	Steel beams bottom clamp		Fig. 229 beam clamp with extension piece
	Steel beams top clamp		Fig. 227 beam clamp
	Steel joists top clamp		Fig. 61 wide throat C-clamp
	Concrete		Fig. 285 [up to 181 kg (400 lb.) load] Fig. 281 [over 181kg (400 lb.) load]

2.6 Hangers and Supports

- .1 All piping shall be supported by adjustable clevis hangers sized to suit the O.D. of the pipe.
- .2 All pipe hangers and trapeze hangers shall be supported by mild steel rod of the correct diameter to suit the hanger, as recommended by the steel manufacturer.
- .3 The load of any hanger rod shall not exceed the capacity indicated in the following table:

<u>Rod Diameter</u>	<u>Maximum Safe Load, Pounds</u>
6 mm (1/4")	136 kg (300lbs)
9 mm (3/8")	277 kg (610 lbs)
13 mm (1/2")	512 kg (1130 lbs)
16 mm (5/8")	821 kg (1810 lbs)
19 mm (3/4")	1229 kg (2710 lbs)

- 
- .4 All vertical runs of pipe shall be supported at each floor by Grinnell Fig. 261 riser clamps. Clamps on copper pipe shall be copper plated.
- .5 Support piping adjacent to expansion joints and loops on Grinnell Fig. 177 roll supports or Fig. 175 roller chair.
- .6 Support piping adjacent to large motor driven equipment equipped with spring isolation Fig. 178 cushion hangers. Also, piping adjacent to major pieces of equipment such as boilers, chillers, heat exchanger, etc. shall be supported on Fig. 178 cushion hangers.
- 2.7 Pipeline Strainers
- .1 Pipe line strainers shall be Sarco Type BT bronze body strainers for sizes up to 75 mm (3"). Sarco Type CIF- 125 strainers shall be used for sizes 100 mm (4") and larger. Toyo Fig. 380 may be substituted for sizes up to 50 mm (2").
- 2.8 Thermometers
- .1 Thermometers shall be Ashcroft 6260 bi-metal dial thermometers with stainless steel casings, bronze or stainless steel stems, and 304 stainless steel separable threaded wells. Scale ranges to be as follows:  
- Heating systems: plus 10°C (50°F) to 113.334°C (300°F)
- .2 Thermometers located up to 1500 mm (5'0") above finished floor to have 75 mm (3") diameter dials and located above 1500 mm (5'0") to have 125 mm (5") diameter dials.
- .3 Separable wells shall have insulation extensions where mounted on insulated piping or equipment.
- 2.9 Pressure Gauges
- .1 Pressure gauges on suction and discharges of pumps and where notes shall be Ashcroft type 1009 gauges with stainless steel case, bourdon tube and movement.
- .2 Gauges shall have 113 mm (4 ½") dials.
- .3 Gauges to have brass tee handle cock on inlets and shall have pulsation dampers when mounted adjacent to pumps. Gauges, subject to vibration, shall have copper tube extensions and shall be located away from source of vibration, preferably on an adjacent wall or other stable mounting surface.
- 2.10 Flanges
- .1 Flanges for service up to 862 kPa (125 Psi) shall be 1034 kPa (150 lb) rated to ASTM A181 - grade I either raised or flat face to suit fittings or match adjacent flange.
- .2 Flange bolts shall be grade 5 or better.
- 2.11 Flange Gaskets
- .1 Gaskets for potable water and fire service shall be 1.5 mm

(1/16") thick full face pre-punched cloth inserted rubber gaskets.

- .2 Site or shop cut gaskets will not be acceptable. Ring gaskets shall be used on all raised flanges and full faced gaskets on all flat faced flanges.

PART 3 - EXECUTION

3.1 General

- .1 Provide sufficient hangers, supports, anchors, guides, vibration dampeners, flexible connectors, restraints and sway braces that will cope with the loads, moments and stresses developed in the piping system and prevent these loads and moments from being transferred to the equipment to which the piping is connected.
- .2 Connect all piping systems to equipment without springing the pipes or transferring any loads or moments to the equipment.
- .3 The use of tees in bullhead configuration is unacceptable.

3.2 Valve Installation

- .1 Install valves as shown on the Drawings, and as may otherwise be required to allow for shutdown and repair for each fixture or group of fixtures in plumbing systems.
- .2 Install shut-off valves with unions or couplings on supply and return piping connections to each piece of equipment to facilitate repair shutdown.
- .3 Install valves with stems in the horizontal or upright position. Valves installed with stems in an inverted position are unacceptable.

3.3 Pipe Hanging

- .1 Piping suspended with hangers shall have the following hanger size and spacing:

All piping (except copper and PVC).

Pipe Size	Diameter	Rod Max. Spacing
30 mm (1-1/4") & under	10 mm (3/8")	2450 mm (8')
35 mm (1-1/2") to 50 mm (2")	10 mm (3/8")	3000 mm (10')
65 mm (2-1/2") to 85 mm (3-1/2")	12 mm (1/2")	3650 mm (12')
100 mm (4")	16 mm (5/8")	3650 mm (12')
150 mm (6")	19 mm (3/4")	3650 mm (12')
Copper Pipe	Rod	

Pipe Size	Diameter	Rod Max. Spacing
25 mm (1") & under	10 mm (3/8")	1825 mm (6')
30 mm (1-1/4") to 35 mm (1-1/2")	10 mm (3/8")	2450 mm (8')
50 mm (2") and 65 mm (2-1/2")	12 mm (1/2")	2750 mm (9')

- .2 Install hangers within 300 mm (12") of each horizontal elbow.
- .3 Where floor or roof structural system consists of joists, piping shall be supported by means of angles spanning the top chords of adjacent joists. The number of joists to be spanned shall be determined by the incident load of piping.
- .4 In no case shall the hanging of piping directly from roof decking be allowed, unless special permission is obtained from the Contract Administrator.
- .5 All hanger rods shall have sufficient threaded length to allow for vertical adjustment of hangers after pipe is in place. Use two (2) nuts on each rod, one above the clevis or angle iron and one below.
- .6 Hangers for insulated cold piping shall be oversized to match outside diameter of insulation and provided with a protection saddle of 16 ga. galvanized sheet steel, rolled to match the outside diameter of the insulation. The saddle shall cover approximately the bottom one third of the circumference of the insulation. The length shall be at least as long as that recommended by the insulation manufacturer.
- .7 Where pipe or equipment is supported from floors or walls, structural steel supports shall be fabricated using welded joints except where provision is required for adjustment. Where details of construction are not indicated, drawings shall be submitted to the Contract Administrator for approval before fabrication.

3.4 Pipe Grading

- .1 Piping shall be graded and fitted with drain valves at low points to facilitate complete system drainage.
- .2 Plumbing drain lines shall be graded according to the Canadian Plumbing Code. (Pipe sizes shown on drawings are generally based on a pipe slope of 1%.)



- 
- .3 Gas piping shall be graded down in direction of flow to a pipe dirt leg.
- 3.5 Pipe Connections
- .1 Piping connections to equipment for pipe sizes up to 65 mm (2-1/2") connections shall be made with unions, pipe sizes 65 mm (2-1/2") and over shall be flanged.
- .2 Copper to inside I.P.S. adaptors and dielectric fittings shall be used where steel piping connections are made to copper.
- .3 Provide flanged joints intermittently in all welded piping systems adjacent to equipment to facilitate removal of the piping system by two men and without cutting any pipe or joint.
- .4 Provide unions or flanges on both sides of equipment, coils, pumps, condensate traps, separators, etc. incorporated into piping systems with screwed joints.
- .5 Copper pipe jointing materials shall utilize silver solder to conform to the requirements of the Plumbing Authority and code.
- .6 PVC solvent cement jointing shall be in accordance with suggested manufacturers installation guide using I.P.S. cement and primer in accordance with ASTM D2564 (PVC) ASTM F493 (CPVC).
- 3.6 Pipe Line Strainers
- .1 Install strainers upstream of all control valves.
- .2 Strainers shall be installed in horizontal piping with basket under pipe or in vertical piping in the down leg only.
- .3 Provide valved sediment blowoff for basket on strainers 38 mm (1 1/2") and larger.
- 3.7 Expansion Pieces
- .1 Install piping to permit free movement of piping caused by thermal expansion and contraction, except where it is specifically noted as being secured.
- .2 Provide for expansion and contraction by installing suitable expansion pieces or flexible connectors as is necessary or where indicated to protect restrained pipe runs from thermal expansion.
- 3.8 Gauges & Thermometers
- .1 Install thermometers on the inlet and discharge of water heating equipment.
- .2 Install pressure gauge on both sides of pressure control stations.

END OF SECTION 15300

---

PART 1 - GENERAL

1.1 General Conditions Mechanical General Conditions 15010 shall be part of this section.

1.2 Work Included The following list generally describes the scope of work under this section:

- Natural gas distribution system.
- Exhaust piping for emergency generator.
- Potable water piping, c/w valves and fittings.
- Sanitary drainage and vent piping.
- Operating and maintenance instructions.

1.3 Related Work Specified Elsewhere

Concrete Equipment Bases and Pits                      Section 03300  
Line Voltage Wiring and Motor Starters                      Division 16

1.4 Qualifications

- .1 Work shall be installed by qualified workmen who are fully familiar with this work and have a working knowledge of the systems components.
- .2 The Contractor shall be fully familiar with governing regulations having jurisdiction on this project.

1.5 Plumbing Codes

- .1 Work shall be installed in accordance with local code requirements except where more stringent requirements are specified under this section.
- .2 Where local code requirements are at variance with this section of specification, the work shall be installed in accordance with the local code requirements at no additional cost to this Contract.

1.6 Natural Gas Service

- .1 Arrange with the local utility for the installation of a gas service to the project. Pay all applicable fees and assessments relative to obtaining the service and establish clearly with the utility the work to be completed by this section.

PART 2 - PRODUCTS

2.1 Floor Drains

PL-8 Floor Drain

Watts FD-460-F epoxy coated cast iron drain body with 300 mm (12") square epoxy coated heavy duty grate with outlet to suit.

2.2 Clean-Outs

- .1 Drain line cleanouts in floor surfaces shall be Watts CO-200-R with round nickel bronze cover

- 2.3 Backflow Prevention .1 Provide backflow prevention devices in all locations required by authorities but at a minimum provide the following:
- Connections to liquid filled mechanical systems (water heating, glycol heating, cooling towers, etc. - reduced pressure zone BFP
  - Connections with hose couplings - atmospheric vacuum breakers

- 2.4 Pressure Reducing Valve .1 Singer Model 106 PR pilot operated pressure reducing valve sized for a flow of 300 USGPM and an outlet pressure of 25 PSI (adjustable) with inlet water pressure of 70 PSI maximum. Valve shall come complete with stainless steel seat and stem.

PART 3 - EXECUTION

- 3.1 Hub Drains .1 Hub drains shall be installed with top of hub 100mm (4") above floor level.

- 3.2 Natural Gas Piping .1 All gas piping shall be installed and tested in complete conformance with CSA and CGA standards and the requirements and regulations of the Provincial Department of Labour and all other authorities having jurisdiction. Gas piping materials, fittings and joints shall also conform to the requirements of all authorities having jurisdiction. Arrange and pay for all necessary inspections, permits, fees and tests required by the authorities.
- .2 Gas pressure reducing valves shall be installed complete with vent pipes to atmosphere as required by the Department of Labour.

- 3.3 Engine Exhaust Piping .1 Provide and install a complete engine exhaust system from the emergency generator, through the wall to outdoors. Include installation of flexible connectors and muffler provided with engine and install through wall thimble and discharge protection.

END OF SECTION 15400

---

PART 1 - GENERAL

- 1.1 General Conditions .1 Mechanical General Conditions 15010 shall be part of this section.
- 1.2 Work Included .1 The following list generally describes the scope of work under this section:
- Ductwork, dampers, and duct fittings.
- 1.3 Related Work Specified Elsewhere Insulation Section 15180
- 1.4 Qualifications .1 Ductwork shall be installed by qualified workmen who are fully familiar with the SMACNA and ASHRAE Duct Construction Standards.
- .2 Systems and equipment shall be installed by qualified workmen who are familiar with this work and have a working knowledge of the system components.
- .3 The Contractor shall be fully aware of the Provincial regulations governing the details of this work regarding the installation of fire dampers, electric heating equipment, etc.
- 1.5 Local Regulations .1 Work shall be installed in accordance with local regulations governing this work except where more stringent requirements are specified under this section.
- .2 Where local regulations are at variance with contract specifications, work shall be installed in accordance with local regulations at no additional cost to this contract, after obtaining the Contract Administrator's approval.
- 1.6 Dimensions .1 Duct dimensions shown on the drawings are inside sizes. Ducts lined with insulation, shall be increased in size as required to maintain specified internal dimensions.
- 1.7 Bracing .1 Ductwork shall be braced to prevent movement. Additional bracing and/or supports shall be provided at no extra cost to the City where required by the inspection authority.

PART 2 - PRODUCTS

- 2.1 Ductwork .1 Sheet metal ductwork shall be constructed in accordance with the latest editions of applicable NFPA Standards, SMACNA Low Pressure Duct Construction Standards, ASHRAE Equipment Guide, and Detail Drawings included with this specification.

- .2 Duct hangers shall be constructed in accordance with SMACNA Low Pressure Duct Construction Standards or as further specified.
- 2.2 Dampers .1 Motorized Dampers shall be TAMCO 9000 aluminium airfoil low leak type with seals. Refer to drawings for sizes.
- 2.2 Duct Sealants .1 All low pressure ductwork shall have Duro Dyne S-2 duct sealer applied to joints and seams. Latex duct sealers are not acceptable.
- 2.3 Hangers .1 Support all horizontal ductwork with non-perforated, galvanized steel, or rods and angle iron passing under ducts according to the following schedule:

Longest Dimension of Duct	Trapeze		Shelf Angles	Maximum Spacing
	Round Hangers	Strap Hangers		
Up to 450 mm (18")	6 mm (1/4") Rod	25 mm (1") x 18 Ga.	25x25x3 mm (1"x1"x1/8")	3000 mm (10'-0")
475 thru 750 mm (19"-30")	6 mm (1/4") Rod	25 mm (1") x 16 Ga.	25x25x3 mm (1"x1"x1/8")	3000 mm (10'-0")

PART 3 - EXECUTION

- 3.1 Ductwork .1 Sheet metal ductwork shall be installed in accordance with the recommendations of the SMACNA Low Velocity Ductwork Standards. Double thickness turning vanes shall be installed in all 90° square turn elbows having no change in dimension through turn.
- .2 Where duct elbows are round, they shall have a radius dimension of 1 1/2 times the width of duct (in the plane of the turn) to the center line of the duct.
- .3 No turning vanes shall be installed in duct elbows that are branch duct connections to plenums or directly behind return air grilles.
- .4 Variation of duct sizes will be permitted only after obtaining written permission of the Contract Administrator.
- .5 Rectangular ductwork exceeding 450 mm (18") in any dimension shall be stiffened by breaking the sheets diagonally. Cross breaking may be omitted for insulated ductwork, provided ducts are 2 gauges heavier than scheduled.

- 
- .6 Rectangular ducts shall be constructed by breaking the corners and grooving the longitudinal seams using Pittsburg seam or other approved airtight seam.
- .7 All laps in sheet metal shall be in the direction of air flow. All edges and slips shall be hammered down to leave a smooth interior duct.
- 3.2 Duct Joint Sealing
- .1 Clean all ductwork prior to application of sealer to ensure that it is dry and free of grease, etc. Seal shall consist of a 6 mm (1/4") bead of the material along all joints, which when dry shall be minimum 3 mm (1/8") thick at joints and seams and shall extend a minimum of 13 mm (1/2") on each side of the joint.
- .2 Application shall be in strict accordance with the sealant manufacturer's recommendations. Samples shall be submitted to the Contract Administrator on request.
- 3.3 Dampers
- .1 Motorized dampers shall be installed where shown on the drawings.
- .2 Fresh air dampers shall be carefully sealed around frames with duct sealant.
- 3.4 Supports and Hangers
- .1 Supports shall secure ducts and equipment, prevent sway, sag and duct vibrations, provide for expansion and contraction, and shall have a neat appearance.
- .2 Supports shall be designed for strength and rigidity in a manner which does not stress the building construction.
- .3 Take care not to weaken concrete or penetrate waterproofing.
- .4 If possible, hangers and supports for covered ducts shall not injure or pierce insulation. If there is no alternative, the insulation covering shall be repaired to the Contract Administrator's satisfaction.
- .5 Provide sheet metal shields to protect insulation at areas of contact with hangers and supports.
- .6 In no case shall the hanging of equipment directly from roof decking be allowed, unless special permission is obtained from the Contract Administrator.

END OF SECTION 15800

---

PART 1 - GENERAL

- 1.1 General Conditions .1 Mechanical General Conditions 15010 and Division 16 shall be part of this section.
- 1.2 Work Included .1 Supply and installation of new damper motors.  
.2 Supply and installation of new modulating damper controller.  
.3 Supply and installation of gas detection system.
- 1.3 Related Work Specified Elsewhere The following work shall not be included under this Section:  
a) Supply and installation of all wiring and conduit for temperature control systems specified in this section – and by Division 16.
- 1.4 Work by Others .1 Remote alarm to McPhillips Control Station to be provided by the City.

PART 2 - PRODUCTS

- 2.1 Dampers and Damper Motors .1 Damper motors shall be Belimo AF120-S US.  
.2 Damper motor for exhaust damper shall include optional Auxiliary switches for fan start-up interlock.
- 2.2 Electronic Temperature Control .1 Supply and installation of Johnson Controls T26, 120V, line voltage thermostat. Thermostat to start ventilation fan and open dampers above 30°C as stated in sequence of operation.
- 2.3 Methane Gas Detection .1 Provide all labour, materials, products, equipment and service to supply and install a methane gas detection and control system as indicated on the drawings and specified in this section.  
.2 The Vulcan 201m gas detection monitor will be powered by a power transformer rated at 17-27 Vac or by an external power supply rated at 17-27 Vac or 24-38 Vdc. Capable of remote sensing at distances of up to 300 feet, the gas monitor will incorporate a catalytic combustion cell for CH<sub>4</sub>. The unit's sensing cell must compensate for variations in relative humidity and temperature to maintain high levels of accuracy.

The Monitor will incorporate two DPDT relays 5A, 30 Vdc or 250 Vac (resistive load) that will be activated at two programmable set points (and programmable time delays) for local activation of fans / louvers & solenoid shut off valve.

A 10-step LED display will provide gas concentration readings. A green LED will indicate normal operation and a yellow LED will indicate fault operation. The Monitor must also incorporating an audible alarm (rated at no less than 65Db at a distance of three feet), which can be activated at fully programmable levels.

The monitor will be capable of operating within relative humidity ranges of 5-90% and temperature ranges of 32°F to 100°F (0°C to 40°C).

The unit will be manufactured to UL 1244 label and CSA 22.2. The Monitor must be manufactured within an ISO 9001-2000 production environment.

Monitor alarm levels are to activate alarm relays and the unit is to be installed in accordance with the following parameters:

COMBUSTIBLE GASES	FIRST ALARM SET POINT	SECOND ALARM SET POINT	SENSOR LOCATION	RADIUS OF COVERAGE
Methane, Nat Gas , (CH-4)	10% LEL	20% LEL	1 ft below the ceiling	20 feet

- .3 Provide complete commissioning service by the manufacturer's authorized representative and provide commissioning report to the Contract Administrator.

**PART 3 – SEQUENCE OF OPERATION**

**3.1 Intake and Exhaust Dampers**

- .1 Line voltage thermostat shall open fresh and exhaust air dampers and operate exhaust fan when temperature in space is 30°C or higher.

**3.1 Exhaust Fan**

- .1 Exhaust fan shall start from exhaust damper actuator end position auxiliary switch.

**3.3 Gas Detection**

- .1 Upon sensing 10% LEL of methane, the corresponding indicator light shall energize, audible local alarm shall sound, remote alarm (to McPhillips Control Station) shall activate, intake and exhaust air dampers shall open fully



and exhaust fan shall start. If the gas levels fall below the first alarm set-point and a differential (2 to 4%), the alarm shall clear, intake and exhaust dampers shall close and the exhaust fan will stop.

- .2 Upon sensing 20% LEL of methane, the corresponding indicator light shall energize, audible local alarm shall sound, remote alarm (to McPhillips Control Station) shall activate, intake and exhaust air dampers shall continue operation, exhaust fan shall continue operation and the gas solenoid shut off valve shall close. The gas solenoid shut off valve shall latch closed (field installed relay) and require manual reset after gas levels have returned to normal.

END OF SECTION 15900