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## **PART 1 - GENERAL**

### **1.1 DRAWINGS**

- .1 Mechanical drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
- .2 Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet the conditions. Conserve headroom and interfere as little as possible with the free use of space.
- .3 Record differences between mechanical work as installed and as shown in Contract Document changes on a set of prints of mechanical drawings to be furnished by Contract Administrator. Return these prints to Contract Administrator at completion of Project for review. These will then be returned to the Contractor to prepare "As-Builts Drawings".

### **1.2 SCOPE OF WORK**

- .1 Work to include all labour, material, and equipment, required for installing, testing, and placing in initial operation "All" Structural, Division 15000 and 16000 Sections as detailed in the specifications and as shown on the drawings. Cost to include night work including security costs as required to meet the schedule. Carry the cost to patch and paint where walls, portion of walls require part dismantling to modify the existing piping to change from steam heat to hot water heat.

### **1.3 JOB SUPERINTENDENT SUPERVISION**

- .1 The Contractor shall keep a competent superintendent on the job Site. This Contract Administrator shall have full charge of the work and shall be responsible to see that the Work of all trades is properly carried out in accordance with the standards set forth in the drawings and specifications.

### **1.4 SITE VISIT REPORT**

- .1 This Contractor's Work will be reviewed periodically by the Contract Administrator, solely for purpose of determining general quality of Work, and or other Work performed.
  - .1 Erect and install Work in all it's parts in a safe and workmanlike manner in accordance with plans and specifications, nor impose upon Contract Administrator, any responsibility to supervise or oversee erection or installation of any work.

### **1.5 LIABILITY**

- .1 Install work in advance of concrete pouring or similar work. Provide and set pipe/ductwork sleeves as required.
- .2 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to Project.
- .3 Protect and maintain work until building has been completed and accepted. Protect work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of work, without expense to Project.
- .4 Cooperate with all trades to ensure proper installation of all equipment. Review all contract drawings.
- .5 On completion of work, remove tools, surplus and waste material and leave work in clean, perfect condition.

**1.6 WELDING REGULATIONS**

- .1 Do the work in accordance with the following standards except where specified otherwise:
  - .1 ANSI/ASME B31.1- Latest Edition: ASME Code for Pressure Piping and Power piping.
  - .2 CSA W48 series Electrodes.
  - .3 CSA B51-M- Latest Edition, ASME Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CAN/CSA-W117.2-M- Latest Edition, Code for safety in welding and cutting (Requirements for welding operators).
  - .5 AWS B3.0- Latest Edition, Welding procedures and performance qualifications.
- .2 Welders Qualifications
  - .1 Welding qualifications to be in accordance with CSA B51-M- Latest Edition.
  - .2 Use qualified and licensed welders possessing certificate for each procedure to be performed from Authority having Jurisdiction.
  - .3 Furnish welder's qualifications to Contract Administrator.
  - .4 Each welder to possess identification stamp issued by Authority having Jurisdiction.
- .3 Include for hot work permits, fire watch with fire protection, as review approved by City and Contract Administrator..

**1.7 MATERIALS**

- .1 Motor and equipment name plates as well as applicable ULC and CSA labels shall be in place when Project is turned over.
- .2 Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents:
  - .1 Promptly notify Contract Administrator in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain Contract Administrator's written instructions before proceeding with work. Bear expenses arising from correcting deficiencies of work that do not comply with Manufacturer's directions or such written instructions from Contract Administrator.
- .3 Follow Manufacturer's directions in delivery, storage, protection, installation of equipment and materials.
- .4 Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury. Equipment to be readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.
- .5 Materials of same general type to be of same manufacture (e.g. all air supply units shall be of same manufacturer).
- .6 Provide accessible lubricating means for bearing, including permanent lubricated 'Lifetime' bearings.
- .7 Equipment listed as 'equal' shall be done in accordance with B6. Substitutes by Contractor must meet all space requirements, specified capacities and must have factory suitable options and equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with manufacturer's published recommendations.

**1.8 FLASHING**

- .1 Where pipes or ducts go through a roof or wall (and/or removed), they should be boxed-in and flashed. Allow for expansion and contraction of pipe. Flashing shall be insulated and waterproof.

**1.9 FLOOR PLATES AND SLEEVES**

- .1 Set sleeves in concrete forms for all pipes and ducts passing through concrete walls, beams and slabs. (New)
- .2 Pipe sleeves (c/w waterproof sealant) to extend above floor lines (c/w waterproof sealant) as follows:
  - .1 Unfinished areas - 25 mm (1").
  - .2 Finished areas - 6 mm (1/4").
  - .3 Mechanical rooms - 50 mm (2").
- .3 Pipes passing through floors and walls in finished areas and where exposed to view (SEE ESCUTCHEONS).
- .4 Pipes passing through fire rated walls, floors and partitions (SEE OPENINGS IN FIRE SEPARATIONS).
- .5 Sleeves and holes for all piping are to be large enough to accommodate pipe insulation.

**1.10 ESCUTCHEONS**

- .1 On pipes through walls, partitions, floors and ceilings in finished areas:
  - .1 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.
  - .2 Outside diameter to cover opening or sleeve.
  - .3 Inside diameter to fit around finished pipe.

**1.11 CUTTING AND PATCHING**

- .1 Locate holes and provide sleeves, cutting, and fittings required for mechanical work. Relocate improperly located holes and sleeves.
- .2 Drill for expansion bolts, hanger rods, brackets and supports.
- .3 Provide openings and holes required in precast members for mechanical work.
- .4 Patching of finished construction of building shall be performed by qualified tradesmen.

**1.12 OPENINGS IN FIRE SEPARATIONS**

- .1 Mechanical trades having openings in fire separations for passage of pipes, duct, etc., are responsible for fire-stopping around such holes in order to maintain integrity of fire separations. Work shall be performed by a licensed qualified tradesperson.
- .2 Fire-stopping:
  - .1 Fire-stopping to be Fire-barrier non-combustible, semi rigid, mineral fibre felts.
  - .2 Material shall be of density, width and depth to maintain assembly fire resistive rating.
  - .3 Fire-stopping used shall be listed, and a bear label of Underwriters' Laboratories of Canada Guide Number.
- .3 Impaling Clips:
  - .1 50 mm (2") wide x 0.6 mm (24 ga.) steel, z-formed configuration with bottom dimension conforming to opening size listed in manufacturer's sizing chart. Install as required.
- .4 Installation:
  - .1 Install fire-stopping with minimum 25% compression in accordance with manufacturer's recommendations and ULC test requirements. (CAN4-S115M - Latest Edition)
  - .2 Butt succeeding sections of fire-stopping tightly up against the preceding. Leave no voids.
  - .3 Use two impaling clips per 1.2 m (48") length of fire-stopping material, to support and secure fire-stopping.

**1.13 SUPPORTS BASES, PITS (SEE DWG. DS-1)**

- .1 Supply and erect all special structural work required for installation of tanks, pumps, fans, motors and other apparatus.
- .2 Concrete pads, concrete for floating bases, curbs and pits: see drawings for responsibility.
  - .1 Supply all anchor bolts, fasteners and foundation drawings. Unless noted otherwise, all major pieces of equipment such as pumps, compressors, fans, etc. to be mounted on 100 mm (4") concrete pad.
- .3 Mount equipment suspended above floor level (not detailed) on platform bracketed from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either building structure, ceilings or floor, or both as required (See HANGERS AND SUPPORTS).

**1.14 TRIAL USAGE**

- .1 Contract Administrator reserves right to use any piece of mechanical equipment, device or material installed under this Contract, for such reasonable lengths of time and at such times as Contract Administrator may require, to make complete and thorough test of same, before final completion and acceptance of any work. Such tests not to be construed as evidence of acceptance of any part of contract. It is agreed and understood, that no claim for damage will be made for any injury or breakage to any part or parts of the above due to aforementioned tests, weather caused by weakness or inaccuracy of parts, or by defective materials or workmanship of any kind whatsoever, Contractor to supply all labour and equipment for such tests.

**1.15 TEMPORARY USE OF EQUIPMENT**

- .1 Permanent systems and/or equipment not to be used during construction period, without Contract Administrator's written permission.
- .2 Equipment used during construction period to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of Contract Administrator.
- .3 Provide proper care, attention and maintenance for equipment while it is being used. If, in opinion of Contract Administrator, sufficient care and maintenance is not being given to equipment and systems, Contract Administrator reserves right to forbid further use of said equipment and systems.

**1.16 MECHANICAL SHOP DRAWINGS**

- .1 Contractor shall submit for review a minimum of six sets of detailed shop drawings. Refer to clause "Appendix of Manufacturers" for shop drawing requirements.
  - .1 Check shop drawings for conformity to plans and specifications before submission.
  - .2 Include name of project, equipment supplier and clause number equipment is specified. Drawings shall bear the approval stamps and signatures of the Trades involved in the properly co-ordinated installation of the equipment.
- .2 Shop drawings shall be submitted metric/Imperial units.
- .3 Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure of catalogue material. Do not assume applicable catalogues are available in the Contract Administrator's Office. Maintenance and operating manuals are not suitable submittal.
- .4 Clearly mark each sheet of printed submittal material (using arrows, underlining or circling) to show particular sizes, types, model numbers, ratings, pressure drops capacities, performance

and factory available options actually being proposed. Cross out non-applicable material. Note on the submittal specified features such as special tank linings, pump seals, materials or painting.

- .5 Include dimensional data for roughing in and installation, technical data sufficient to check that equipment meets requirements of drawings and specifications. Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.
- .6 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.
- .7 Take full responsibility for securing and verifying field dimensions. In case where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be worked to and ensure that other trade are aware of these dimensions and shall comply to them.
- .8 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such errors or interferences but Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or interferences or from necessity of furnishing such work, and materials as may be required for completion of work as called for in Contract Document.

#### 1.17 OPERATION AND MAINTENANCE MANUAL

- .1 Contractor shall provide Contract Administrator with three (3) copies of operating and Maintenance manuals incorporating the following:
  - .1 Bind Operation & Maintenance Manual for Mechanical Systems in the hard-backed binder.
  - .2 Provide a master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.
  - .3 First section shall consist of name, address and phone number of Contract Administrators, Contractors and Sub-Contractors. Also include a complete list of equipment installed with name, address, and phone number vendor.
  - .4 Provide a section for each type of item of equipment.
  - .5 Submit three (3) copies of Operation & Maintenance Manual to Contract Administrator for his approval. Use one of these approved copies during final instruction/inspection and leave with building systems operator.
- .2 Include descriptive literature (Manufacturer's). Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

#### 1.18 AS-BUILT DRAWINGS

- .1 Provide Contract Administrator with one set of As-builts. Label documents "As-Built's" and sign and date documents as certification of accuracy.
  - .1 As-Built's shall show all inverts, all valve tags and revisions as referenced from the original documents. This shall include changes to control systems and low voltage control wiring.
  - .2 Keep Record Documents on site available for review. Drawing updates shall occur weekly.
- .2 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalise production of As-Built Drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm (1/2") high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

- .3 Submit to Contract Administrator for approval and make corrections as directed.
  - .4 TAB to be performed using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .3 Submit copies of as-built drawings for inclusion in final TAB report.

### 1.19 SAFETY DEVICE TESTING

- .1 Make complete inspection of all safety devices alarm or control such as: water alarms; flow switch; freeze protection devices; temperature alarms; pressure switches. Note this to be done prior to TAB, to ensure:
  - .1 That safety devices are complete in accordance with specifications and manufacture's recommendations.
  - .2 That the safety devices are connected and operating according to all local regulations.
  - .3 On completion of the inspections, supply to Contract Administrator letters and/or certificates (forward to O/M Manual) confirming that inspections testing and item have been completed with description of test procedures.

### 1.20 REQUIRED INSTRUCTION

- .1 In addition to authorised site start-up supervision and instructions required of individual equipment manufacturers and systems as noted, Contractor's construction supervisor to instruct in operation and maintenance of all equipment and systems to satisfaction of the Contract Administrator. Instruction period shall occur after pre-final inspection when systems are properly working and before final payment is made. Instruction shall be given using the O&M Manuals. See Table 1.
- .2 Operating instructions shall include:
  - .1 General description of each mechanical system listed above.
  - .2 Step by step procedure to follow in putting each piece of mechanical equipment into operation as well as seasonal shut down.
  - .3 Provide schematic control diagrams for each separate system. Each diagram shall show locations of start-stop switches, insertion sensors, flow switches thermostats, thermometers, firestats, pressure gauges, automatic valves. Mark correct operating settings for each control instrument on these diagrams. See Table 2.
  - .4 Provide diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks electrical switches, and relays.
  - .5 Provide a drawing of each temperature control panel identifying components on the panels and their function.
- .3 Maintenance instructions shall include: Manufacturer's maintenance instructions for each piece of mechanical equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers & lists, operations of equipment, maintenance & lubrication instructions and safety device settings with in acceptable operating ranges.
- .4 Provide services of qualified and experienced personnel to prepare proper documentation and to instruct in the operation and preventative maintenance of equipment and system provided. Complete documentation and turnover prior to final inspection.
- .5 Contractor shall submit to Contract Administrator, suitable document signed by Division Representative stating:
  - .1 The Contract Administrator and City has received satisfactory instruction in operation and maintenance of all equipment and systems as outlined in Article No. 1 of this sub-section.
  - .2 Operation and maintenance manuals have been reviewed with City and Contract Administrator.



- .3 Specified spare parts and special tools of components to be turned over to City. See Table 3.

### 1.21 ACCESS DOORS

- .1 Contractor to provide access doors for concealed valves or groups of valves, hot water heating vents, natural gas vents filters and/or any mechanical equipment required access are built in.
- .2 In general terms, trade responsible for supply the valve/vent, shall provide the access door required to get to the valve, damper, etc. Note this shall include drywall (rated) access doors where required due to ceilings/shafts.
- .3 Access door to be 2.5 mm (12 ga.) steel, 300 mm x 450 mm (12" x 18"), finished prime coat only with concealed hinges, anchor straps, plaster lock and without screw, all equal to Milcor manufacture. Where it is necessary for persons to enter through door, doors to be at least 900 mm x 900 mm (36" x 36").
- .4 In applied tile or exposed glaze or unglazed structural tile, access doors shall take the tile and be sized and located to suit tile patterns. In plaster ceilings, doors shall be c/w with plaster finish to match ceiling. In masonry walls access doors to be sized and located to suit masonry unit sizes. In lay-in acoustic tiles ceilings no access doors are required, install an approved coloured marking device in the ceiling below all points requiring access. (See IDENTIFICATION OF VALVES, PIPING + DUCTWORK.)
- .5 Access doors located in fire rated ceilings and walls shall be an approved ULC stamped Warnock Hersey, fire rated door and shall match that rating, unless otherwise noted.

### 1.22 HANGERS AND SUPPORTS

- .1 General:
  - .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
  - .2 Piping, ductwork and equipment securely supported from building structure. Perforated strap or wire hangers not permitted.
  - .3 Provide suitable attachments equal in quality stated below and where required. Provide fabricated steel supports as required to adequately support piping and equipment. Details to be approved by Contract Administrator. Supports to be of welded construction except where adjustment is required.
  - .4 Hangers to be adjustable after pipe is in place. Parts must be adequate strength for weight to be supported with safety factor of 5 to 1.
  - .5 Provide cadmium plated hangers and supports.
- .2 Horizontal Piping:
  - .1 Hangers (all to be over-sized, size to suit O.D. of exterior pipe insulation) shall adequately support piping system. They shall be located near or at changes in piping direction and concentrated loads. Provide vertical adjustment to maintain pitch required for proper drainage. Allow for piping expansion and contraction. Pipe weight and stresses shall be supported independent of any equipment.
  - .2 Middle Attachment: (Rod)
    - .1 Carbon steel threaded rod black electro-galvanized for mechanical rooms finish.
      - .1 Grinnell Fig. 146.
  - .3 Maximum spacing between pipe supports as specified in paragraphs below or as indicated in table below, whichever is more stringent:
    - .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code, Provincial Code or authority having jurisdiction.
    - .2 Copper piping: up to 12mm (1/2"): every 1.5m (4'-10")
    - .3 Flexible joint roll groove pipe: in accordance with table below but not less than one hanger at joints.

- .4 Within 300mm (12") of each horizontal elbow.
- .5 Provide additional supports for concentrated loads such as valves, specialties and pipe fittings or changes in direction.
- .6 Support plastic pipe in accordance with manufacturer's recommendations for the material and service temperature.
- .7 Steel Pipe:

Size		Distance		Rod	
Mm Ø	In. Ø	M.	Ft.	Mm Ø	In. Ø
up to 31	1 ¼	2.1	7	10	3/8
38	1 ½	2.7	9	10	3/8
50	2	3.0	10	10	3/8
63	2 ½	3.6	12	10	3/8
76	3	3.6	12	10	3/8
100	4	4.2	14	16	5/8
150	6	5.1	17	22	7/8

- .8 Copper Pipe:

Size		Distance		Rod	
Mm Ø	In. Ø	M	In.	Mm Ø	In. Ø
up to 31	1 ¼	1.8	6	10	3/8
38	1 1/2	2.4	8	10	3/8
50	2	2.7	9	10	3/8

- .9 Cast Iron Pipe: (Existing)
  - .1 Maximum spacing - in accordance with Plumbing Code. Locate hangers adjacent to hubs or joints. Support M.J. pipe on both sides of joint. Provide with sway braces and anchors to Contract Administrator's approval. At multiple fittings or short lengths provide sufficient hangers to support all joints to Contract Administrator's satisfaction.

- .3 Horizontal Pipe Attachment
  - .1 Cold piping, steel or cast iron: hot piping steel with less than 25mm (1") horizontal movement, hot piping, steel with more than 300 mm (12") middle attachment (rod) length: adjustable clevis to MSS-SP-58, type 1, ULC listed.
    - .1 Grinnell Fig. 260.
  - .2 Cold copper piping: hot copper piping with less than 25mm (1") horizontal movement, hot copper piping with more than 300 mm middle attachment (rod) length: adjustable clevis to MSS SP-58, type 1. Copper plated.
    - .1 Grinnell Fig. CT-65.
  - .3 Suspended hot piping, steel and copper with horizontal movement in excess of 25mm (1"), hot steel piping with middle attachment (rod) 300mm (12") or less; pipe roller to MSS-SP-58, type 43.
    - .1 Grinnell Fig. 174.
  - .4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.
    - .1 Grinnell Fig. 271.
- .4 Where thermal expansion is excess of 12 mm (1/2") axially is anticipated, or where indicated.
  - .1 Grinnell Fig. 171 Adjustable Pipe Roll
  - .2 Grinnell Fig. 271 Pipe Roll Stand.
- .5 Saddles and Shields

- .1 Cold piping 31mm (1-1/4") and over: protection shield with high density insulation under shield with uninterrupted vapour barrier. Shields shall have minimum length of 300mm (12") to spread weight.
  - .1 Grinnell Fig. 167; Pipe Shields Incorporated.
- .2 Hot piping 31mm (1-1/4") and over: protective saddle with insulation under saddle. Shields shall have minimum length of 300mm (12") to spread weight.
  - .1 Grinnell Fig. 160 to 166; Pipe Shields Incorporated
- .6 Vertical Pipe Attachment:
  - .1 Steel or cast iron pipe: galvanised carbon steel to MSS-SP-58, type 42, ULC listed.
    - .1 Grinnell Fig. 261.
  - .2 Copper pipe: carbon steel copper finished to MSS-SP-58, type 42.
    - .1 Grinnell Fig. CT-121.
- .7 Equipment:
  - .1 Support hangers with mild steel rod. Load on hanger not to exceed capacity indicated in following table.

Rod Diameter		Maximum Safe Load	
Mm ∅	In. ∅	Kg	Lbs.
10	3/8	277	620
13	1/2	514	1130
16	5/8	822	1818
19	3/4	1232	2710

- .8 Structural Attachments
  - .1 Concrete:
    - .1 Where inserts must be placed in existing concrete use Hilti H.K.D. steel anchors as recommended by manufacturer, or if heavy weights must be supported, drill hole through slab and provide 50 mm x 50 mm (2" x 2") washer and nut above rough slab before floor finish is poured.
    - .2 Inserts for cast-in-place concrete: galvanized steel wedge to MSS-SP-58, type 18, ULC listed for pipe 19mm (3/4") through 200mm (8").
      - .1 Grinnell Fig. 281.
    - .3 Carbon steel plate with clevis for surface mount: malleable iron socket and expansion case and bolt. Minimum two expansion cases and bolts for each hanger.
      - .1 Grinnell, Plate Fig. 49, Eye Nut Fig. 290, Expansion Case Fig. 117.
  - .2 Corrugated Steel Deck
    - .1 Support by 50mm (2") wide piece of 3mm (1/8") thick steel plate placed across top of steel deck, secured to hanger rod by washer and nut; prior to pouring of concrete topping.
  - .3 Steel Beam (bottom flange):
    - .1 Cold piping 50mm (2") and under: malleable iron C clamp to MSS-SP-58, type 19, ULC listed.
      - .1 Grinnell Fig.61
    - .2 Cold piping 63mm (2-1/2") and larger and all hot piping: malleable iron beam clamp to MSS-SP-58, type 28 or 29, ULC listed.
      - .1 Grinnell Fig. 229
  - .4 Steel Beam (top):
    - .1 Cold piping 50mm (2") and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19, ULC listed.
      - .1 Grinnell Fig. 61
  - .5 Wooden Ceilings and Beams:

- .1 Grinnell Fig. 153 Pipe Hanger Flange or Fig. 156 or equal in accordance with B6.
- .6 Steel Joist:
  - .1 Cold piping 50mm (2") and under: steel washer plate with double locking nuts.
    - .1 Grinnell Fig. 60
  - .2 Cold piping 63mm (2-1/2") and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.
    - .1 Grinnell: washer plate, Fig. 60; clevis, Fig. 66; eye nut, Fig. 290.
- .7 Steel channel or angle (bottom):
  - .1 Cold piping 50mm (2") and under: malleable iron C clamp to MSS-SP-58, type 23, ULC listed.
    - .1 Grinnell Fig. 86
  - .2 Cold piping 63mm (2-1/2") and larger and all hot piping; universal channel clamp, ULC listed.
    - .1 Grinnell Fig. 226.
- .8 Steel Channel or Angle (top):
  - .1 Cold piping 50mm (2") and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19, ULC listed.
    - .1 Grinnell Fig. 61.
  - .2 Cold piping 63mm (2-1/2") and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer to MSS-SP-58, type 25, ULC listed.
    - .1 Grinnell Fig. 227.

### 1.23 THERMOMETERS & PRESSURE GAUGES

- .1 Direct Reading Thermometers:
  - .1 Dial type, having stainless steel cases, rings and stems, glass covers and adjustable pointers. Accuracy to be 1% of full span. Thermometers to operate at mid point of scale or range.
  - .2 Thermometers to have 76 mm (3") dia. Dials. Use back or bottom inlet stems, whichever is best suited for ease or reading. Choice of stem types shall not be made until piping and equipment, etc. has been erected. Stem type to be approved by Contract Administrator.
- .2 Range: See Temperature Range Table 4.
- .3 Copper, brass or bronze separable wells for copper pipe and stainless steel for steel or plastic pipe to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Stems and wells to be immersed in liquid flow, minimum length of stems to be 152 mm (6").
  - .1 Where a separable well is mounted in pipe 38 mm (1 1/4") dia. or less, enlarge pipe to 50 mm (2") dia. for well length plus 76 mm (3").
- .4 Use pressure gauges on pressure reducing valve stations, sections and discharges of pumps and where noted.
  - .1 Gauges on water system to have a ball valve for shut off.
- .5 Gauges shall have aluminium cases, bronze geared movements, stainless steel bourdon tube, friction glass cover, steel slip ring and precision type pointer. Accuracy to be 1% of full span. Pressure gauges to operate at mid point of scale or range.
  - .1 Range: See Pressure Range Table 5.
- .6 Use 76 mm (3") dials. Gauges chosen with indicating needle at 12 o'clock position for normal operating pressure. Gauges shall have dual indication (ie., kPa, Psi) with kPa prominent figure.

### 1.24 IDENTIFICATION OF VALVES, PIPING & DUCTWORK

- .1 General:

- .1 CAN/CGSB-1.60-m, Interior Alkyd Gloss Enamel.
- .2 CGSB 24-GP-3a, Identification and Classification of Piping Systems.
- .2 Manufacturers' Name Plates:
  - .1 Provide on each piece of equipment. Include registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.
  - .2 Do not apply insulation or paint over plates.
  - .3 Provide pressure vessels with CSA or ASME approval name plates in accordance with requirements of authorities having jurisdiction.
  - .4 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors, all factory supplied.
  - .5 Fasten to equipment according to code requirements.
  - .6 Locate name plates so that they are easily read.
- .3 System Name Plates:
  - .1 Fasten name plates securely in conspicuous place.
  - .2 Minimum size 89 mm x 38 mm x 2.3 mm (3 1/2" x 1 1/2" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6.35 mm high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25 mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.
    - .1 Where equipment (fan, pump, inspector's test) is located above a ceiling in addition to system name plate provide a location name plate 12mm x 50mm (1/2" x 2") laminated phenolic plastic to T-bar track. (See ACCESS DOORS.)
  - .3 Identify as follows: equipment type and number (e.g. pump no.2), service or areas or zone of building served (e.g. south zone chilled water primary).
- .4 Piping:
  - .1 General
    - .1 To CGSB 24-GP-3a.
    - .2 Identify medium by lettered legend, classification by primary and secondary colours, direction of flow by arrows.
  - .2 Sizes:
    - .1 Legend: block capitals. See Piping Sizing Identification Table 6.
    - .2 Primary colour bands:
      - .1 At valves and fittings: 500 mm (18") long.
      - .2 Elsewhere: 1000 mm (3'-3") long.
    - .3 Secondary colour bands: 50 mm (2") wide, 75 mm (3") in from one end of primary colour band.
    - .4 Arrows:
      - .1 Outside diameter of pipe/insulation 75 mm (3") and greater: 150 mm (6") long x 50 mm (2") high.
      - .2 Outside diameter of pipe/insulation less than 75 mm (3"): 100 mm (4") long x 50 mm (2") high.
      - .3 Use double headed arrows where flow is reversible.
  - .3 Material:
    - .1 Paint: to CGSB 1-GP-60M.
    - .2 Legend markers, arrow colour bands: plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150°C (300° F) and intermittent temperature of 200°C (400° F). Apply to prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping one (1) pipe diameter.
      - .1 WH Brady Identification.

- .3 Waterproof and heat resistant plastic marker tags: for pipes and tubing 20 mm (3/4") nominal and smaller.
- .4 Colours:
  - .1 Where not covered by pipe and valve identification table, submit legend, primary and secondary classification colours to for approval.
  - .2 Table 7: Pipe and valve identification.
- .5 Legend and arrows:
  - .1 Black or white to contrast with primary colour.
  - .2 Fire protection: white on red background.
- .5 Ductwork:
  - .1 50 mm (2") high black stencilled letters and directional flow arrows 150 mm (6") long x 50 mm (2") high.
- .6 Valves, operating controllers.
  - .1 Identify valves, controls and gauges by label of 3 mm (1/8") plastic engraving stock with white lettering on black background. Size approximately 12 mm x 25 mm (1/2" x 1") high. Secured to items with non-ferrous chains or "S" hooks.
  - .2 Consecutively number valves in systems.
  - .3 Provide Contract Administrator with (six) 6 typewritten lists of valve numbers giving description, type, duty, location and normal operating position valves. All locations to be marked on "As-Builts".
  - .4 Identify medium by letter legend, classification by primary and secondary colours, direction of flow by arrows.
  - .5 Furnish identification flow diagrams of approved size for each system designating number, service, function and location with operating position of valve and operating temperature/pressure at gauge/thermometer, and fail safe position.
- .7 Controls Identification:
  - .1 Identify all systems, equipment, components, controls and sensors.
  - .2 Inscription to identify function and, (where applicable) fail - safe position.
  - .3 Low voltage control wiring and/or hard inter-locks installed by the Contractor.

### 1.25 ELECTRIC MOTOR, ETC.

- .1 Provide (where available) NEMA Premium Efficiency motors supplier to Indicate Motors Which Meet or Exceed Nominal Efficiencies For "NEMA Premium® Induction Motors for all equipment supplied in the Division. Motors to operate at 29 r/s (1800rpm), unless noted otherwise. Motor design shall comply with Canadian Electrical Code requirements, CBIP, Powersmart and LEED approved. All electric motors supplied shall be capable of being serviced locally.
- .2 All three phase motors shall have a service factor of 1.15 times nominal rated horsepower of the motor.
- .3 Determine from electrical drawings and specifications, voltage characteristics applying to each individual motor. Where motor voltages are mentioned in this specification, confirmation to be made by reference to electrical drawings and specifications before ordering motors.
  - .1 Provide motors for mechanical equipment as specified.
  - .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Contract Administrator for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
  - .3 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount.
  - .4 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C (100°F).

- .4 Division 16 - Electrical to provide starters for all motors, except as otherwise noted. Division 16 - Electrical shall wire from starters to motors. Wiring required between starters and switching apparatus such as wiring from starters to float switches, pressure switches and all control wiring to be provided by Division 16 - Electrical except as noted otherwise on drawings and in specifications.
- .5 Provide proper terminal connections and lead wires at motors and other apparatus ready for connection by Division 16 - Electrical.
- .6 Provide Division 16 - Electrical with accurate locations of electrical connection points and all necessary schematic and other drawings to facilities electrical work.
- .7 Temperature controls and its related wiring to be furnished by the Contractor along with wiring diagrams. Contractor to supervise control wiring installation. Electrical work and materials by Controls to be in accordance with Division 16. Division 16 - Electrical to be responsible for all other wiring. Contractor shall provide all control wiring unless noted and make final connections for all temperature control wiring as specified. Contractor to instruct Division 16 - Electrical to wire all safety controls in series with "Hand" and "Auto" starter positions to ensure proper system protection.
- .8 Division 16 - Electrical to perform all wiring and make final connections to all other controls for mechanical equipment where the controls are supplied with equipment. Division 15 shall provide wiring diagrams indicating all power and control wiring requirements.

#### 1.26 REMOVALS

- .1 Where existing piping, ductwork, tubing, control panel, equipment and/or devices is no longer to be used as part of the mechanical system the responsible division replacing the above shall completely remove the existing from site.

#### 1.27 EXISTING SYSTEMS

- .1 Where work requires temporary interruption of mechanical services, notify the Contract Administrator 24 hours in advance the length of shutdown and extent of work involved, before service may resume normal operation. This work shall be done during the time actually required to make necessary connections to existing work. Shut down, draining and re-charging of existing (system and/or lines) to accommodate new connections shall be done by the Contractor. Cost for this work to be carried by the Contractor and shall be co-ordinated with the Contract Administrator.
- .2 Carefully dismantle existing mechanical equipment to be removed or relocated, together with reusable materials. Existing equipment, piping, ductwork, conduit, light fixtures which interfere with the new installation shall be temporarily disconnected, remove that which City does not wish to retain shall become the Contractor's property and removed from the site when so directed. Where noted this existing equipment shall be reused in new work after first repairing and reconditioning any defective items (ie, entry doors, frames stair and railing). Permanently disconnected mechanical and electrical connections shall be safely capped and sealed flush within finished surfaces. Remove existing inactive services with interfere with work execution.
- .3 Where portions of the existing building are occupied by City during term of this contract. Schedule new work so normal functions within building are not unduly interrupted. Work in existing building to be scheduled so as to provide minimum of inconvenience to City, i.e Perform work either where areas are vacated during night period or at periods when it is permissible to work in specific areas during daytime. Mechanical Contractor shall submit a schedule for review by the Contract Administrator.

- .4 Arrange work so that interruption of services is kept to a minimum. Obtain permission from Contract Administrator prior to cutting into services. Where deemed necessary by Contract Administrator temporary piping to be installed, and/or work to be carried out at night and on weekends.
- .5 Contractor shall maintain continuous and adequate ventilation heating, fire protection, plumbing, washroom facilities and other services during entire time of the Contract. Provide temporary connections, valving, etc. where necessary to meet this requirement.
- .6 The Contractor shall be responsible for all costs, required to repair all damages to the existing building, equipment, etc., caused through the execution of work in this Contract.

### 1.28 INDOOR AIR QUALITY (IAQ) CONTROL DURING CONSTRUCTION

- .1 Contractor is responsible for maintaining proper and acceptable IAQ during construction.
- .2 Contractor shall follow the guidelines and/or Work procedures laid out in the following publications:
  - .1 Project to comply with the latest version of SMACNA IAQ Guidelines for Occupied Buildings under construction.
  - .2 The Manitoba Workplace Health Regulation.
    - .1 List of IAQ protective measures to be instituted on the site.
    - .2 Schedule for inspection and maintenance of IAQ measures.
    - .3 Contractor is responsible for ensuring that the Work of all Sub-contractors reporting to the Mechanical Contractor adheres to this Section. The Mechanical Contractor shall take appropriate measures to correct his Work or the Work of his Sub-contractors as needed to address IAQ problems during the course of the Work.
      - .1 Control at the source. Measures would include:
        - .1 Using solvent free or less hazardous products.
        - .2 Changing the work process to eliminate the hazard altogether.
      - .2 Control along the path.
        - .1 Use of hoarding c/w negative pressure machines/smoke eaters to maintain a negative pressure in the dirty area relative to the clean area.
      - .3 Control at the Worker using Personal Protective Equipment. Under no circumstances will control at the Worker be an acceptable solution for the occupants affected by the Work.
      - .4 Contractor shall provide MSDS's of all products used in the Work prior to the commencement of the Work.
  - .3 During new construction, dehumidification may be required to control mould growth in ductwork and on porous materials such as drywall installed on smoke seal walls in crawlspaces. If these conditions exist, provide dehumidification units in quantities to keep the indoor RH below 60%, where the following conditions exist:
    - .1 Indoor air conditions are likely to exceed 25 °C and 60% RH for a period of 24 hours.

### 1.29 APPENDIX OF MANUFACTURERS

- .1 Following Appendix of Manufacturers lists manufacturers of equipment and materials acceptable to Contract Administrator, subject to individual clauses under the various sub-sections of Mechanical Work Specifications. See item 'Materials' under this section of specification.
- .2 Product noted in individual specification clauses is an item that meets specification in all respects regarding performance, quality of material and workmanship, and is acceptable to Contract Administrator without qualification. Equipment proposed from other manufacturers listed as 'Approved Manufacturers' and alternates shall meet same standards.



- .3 Submit shop drawings for all items marked with asterisk (\*).

**EQUIPMENT OR MATERIAL:**

**.1 ELECTRIC MOTORS:**

- .1 High efficiency "NEMA Premium® Induction Motors (30 RPS maximum speed unless noted otherwise)  
.1 Canadian General; Electric; Westinghouse; Lincoln; Baldor; Century

**.2 PLUMBING:**

- .1 Valves  
.1 Gate & Globe\*  
.1 Crane, Nibco, Toyo Type: Rising Stem  
.2 Check Valves (all to be in the horizontal) \*  
.1 Crane, Nibco, Toyo  
.3 Strainers\*  
.1 Sarco-Canada; Trane; Dunham, Crane, Nibco, Toyo  
.4 Safety & Relief\*  
.1 Consolidated; Farris; Watts; Cash-Acme; Kunkle  
.5 PRV\*  
.1 Fisher  
.2 Pressure Gauges\*  
.1 Dresser; Morrison; Marshalltown; Marsh Hydropoise; H.O. Trerice, Weiss; Ashcroft

**.3 AIR DISTRIBUTION:**

- .1 Ductwork:  
.1 Spiral Duct\*  
.1 United; Westeel; Air-O  
.2 Flexible Ductwork\*  
.1 Thermoflex; Wiremould; Flexmaster  
.2 Ducturns, Damper Hardware Fan Connections\*  
.1 Duro-Dyne; Elgin  
.3 Manual Damper Regulators\*  
.1 Young  
.4 Pitot Tube Enclosures\*  
.1 Lawson Taylor, Tek-Air  
.5 Duct Sealer  
.1 Duro-Dyne; 3M; United; Hardcast  
.6 Grilles\*  
.1 Airolite; Air-O-Vent ; Penn; Airmaster; Canadian Advanced Air

**.4 CONTROLS/INSTRUMENTATION:**

- .1 Controls sub-contractor\*  
.1 Johnson, BSD Solutions, Barcol

**.5 H.V.A.C. BALANCE & TESTING:**

- .1 Air and Fluid Balances  
.1 Air Movement & Mechanical Services; DFC, AHS, Airdronics

**PART 2 - SCHEDULES**

**TABLE 1 - REQUIRED SYSTEM INSTRUCTION**

System Instruction	Hours
HVAC equipment,: includes controls	6

**TABLE 2 - REQUIRED SCHEMATIC SUBMITTAL**

Required	System Schematic
✓	HVAC equipment,: includes controls

**TABLE 3 - REQUIRED SPARE PARTS**

Required	Spare Parts
✓	Removable handles
✓	Keys
✓	Filters (4 sets)

**TABLE 4 - THERMOMETERS - RANGE**

System	Temperature Range	
	°C	°F
Supply Air Duct	0 to 115	30 to 250
Return Air Duct	0 to 16	30 to 60

**TABLE 5 - PRESSURE GAUGES - RANGE**

System	Pressure Range	
	kPa	Inches
Supply Air Duct	0 - 1000	0 - 4

**TABLE 6 - IDENTIFICATION OF PIPING - SIZING**

Outside Dia. of Pipe or Insulation		Size of Letters	
Mm Ø	In. Ø	Mm	In.
30	1 1/4	13	½
50	2	19	¾
150	6	30	1 ¼

**TABLE 7 - IDENTIFICATION OF PIPING + VALVING - COLOUR**

Pipe Marker Legend	Valve Tag Legend	Primary Colour	Secondary Colour
Natural Gas		Yellow	Orange

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