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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" Division 15000 and 16000 Sections as detailed in the specifications and as shown on the drawings.

**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.

**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' in specifications or submitted as alternate per Clause 26. 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, they should be boxed-in and flashed. Allow for expansion and contraction of pipe. Flashing shall be 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.

**1.13SUPPORTS BASES, PITS**

- .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. Turn anchor bolts over to GC for installation.
- .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).

**1.14V-BELT DRIVES**

- .1 Fit reinforced belts in sheave grooves matched to drive.
- .2 Obtain approval to use cast iron or steel sheaves secured to shafts with removable keys.
- .3 For .75 KW (1HP) to 7.46 KW (10HP) motors use standard adjustable pitch drive sheaves, having plus/minus 10% range. Use mid-position of range for specified rpm.
- .4 For over 7.46 KW (10HP) motors, use sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size as approved by Contract Administrator to suit balancing.
- .5 Use minimum drive rating of two times name plate rating on motor. Keep overhung loads under manufacturer's requirements on all prime mover shafts.
- .6 With belt drive, provide motor slide rail adjustment plates, allowing for 150 mm (6") minimum centre line adjustment.

**1.15MECHANICAL EQUIPMENT GUARDS**

- .1 Meet safety requirements of Provincial Department of Labour and local authorities having jurisdiction. All equipment guards are to be c/w safety chain (isolated) c/w removable clips.
- .2 Provide means to permit lubrication and use of test instruments with guards in place.
- .3 Install belt guards to allow movement of motors for adjusting belt tension.
- .4 Guards for belt drives:
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.58 mm (1/16") thick sheet metal tops and bottoms.
  - .3 38 mm (1 1/2") dia holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .5 Guard for flexible coupling:
  - .1 "U" shaped, minimum 1.58 mm (1/16") thick galvanised mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
  - .1 Wire or expanded metal screen, galvanised, 19 mm (3/4") mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.

**1.16 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.

**1.17 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.

**1.18 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.

### 1.19 OPERATION AND MAINTENANCE MANUAL

- .1 Contractor shall provide Contract Administrator with four (4) 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 four (4) 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.

### 1.20 AS-BUILT DRAWINGS

- .1 Provide Contract Administrator with one set of As-builts reproducible Mylar sepias. 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.

### 1.21 SAFETY DEVICE TESTING

- .1 Make complete inspection of all safety devices alarm or control such as: water alarms; sprinkler alarm valves, tamper switches; flow switch; freeze protection devices; temperature alarms; pressure switches, refrigeration high level/low level alarms; fire dampers. 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.

### 1.22 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.
  - .3 Provide schematic control diagrams for each separate system. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, firestats, pressure gauges, automatic valves, and refrigeration accessories. 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 The City of Winnipeg 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 The City of Winnipeg and Contract Administrator.
  - .3 Specified spare parts and special tools of components to be turned over to The City of Winnipeg . See Table 3.

### 1.23 ACCESS DOORS

- .1 Contractor to provide access doors for concealed valves or groups of valves, flush valves, shock arrestors, trap seal primers, hot water heating vents, filters, coils, dampers/fire dampers, etc., and/or any mechanical equipment required access are built in.
- .2 In general terms, trade responsible for supply the valve, dampers, etc., 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 tile 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.

#### 1.24 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   |
| 200      | 8     | 5.7      | 19  | 22   | 7/8   |
| 250      | 10    | 6.6      | 22  | 22   | 7/8   |
| 300      | 12    | 6.9      | 23  | 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   |
| 63       | 2 1/2 | 3.0      | 10  | 10   | 3/8   |
| 76       | 3     | 3.0      | 10  | 10   | 3/8   |
| 100      | 4     | 3.6      | 12  | 16   | 5/8   |

.9 Cast Iron Pipe:

.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 $\varnothing$ | In. $\varnothing$ | 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.
- .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.

#### 1.25 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.

**1.26 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 Controls sub-contractor.

### 1.27 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 Controls sub-contractor along with wiring diagrams. Factory-trained Representative to supervise control wiring installation. Electrical work and materials by Controls sub-contractor to be in accordance with Division 16. Division 16 - Electrical to be responsible for all other wiring. Controls sub-contractor shall provide all control wiring unless noted and make final connections for all temperature control wiring as specified under Section 'Temperature Control System'. Controls sub-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.

### 1.28 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.

### 1.29 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 The City Of

Winnipeg 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. 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 Portions of the existing building are occupied by The City Of Winnipeg during the 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 The City Of Winnipeg, 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. 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 after regular library hours.
- .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.

### 1.30 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 ASHRAE 62.
  - .2 ASHRAE 55.
  - .3 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 Subcontractors reporting to the Contractor adheres to this Section. The Contractor shall take appropriate measures to correct his Work or the Work of his Subcontractors 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 MSDSs 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.
  - .2 The Contract Documents identify that there is a high water table in the area.
  - .3 Infiltration of water into the crawlspace has occurred.
- .4 The ventilation or crawlspace exhaust system is not intended for dehumidify the space during construction.

### 1.31 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 INSULATION:

- .1 Pipe Insulation
  - .1 Mason; Fibreglas; Atlas; Knauf
- .2 External Duct Insulation
  - .1 Knauf; Mason; Fibreglas;
- .3 Fire Retardant Canvas
  - .1 Alpha-Maritex 3451-RW; Clairmont Diplag 60; S.Fattal Thermocanvas

##### .3 VIBRATION ATTENUATION CONTROL:

- .1 Vibration Isolators\*
  - .1 Vibro-Acoustics; Airmaster; Kinetics
- .2 Expansion Joints and Flexible Connectors\*
  - .1 Fulton; Flexon; Yarway; Vibra

##### .4 PLUMBING:

- .1 Drainage of Waste
  - .1 Cast Iron Soil Pipe
    - .1 Titan
  - .2 Copper/Galvanized
- .2 Mechanical Joints\*
  - .1 Victaulic; Grinnell; Titan
- .3 Expansion Joints and Flexible Connectors\*
  - .1 Fulton; Flexon; Yarway; Vibra
- .4 Hangers and Supports
  - .1 Grinnell; Crane; Myatt
- .5 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 Backflow Preventers\*

- .1 Wikins/Zurn; Watts; Nebco
- .6 Hose Bibbs\*
  - .1 Crane; Emco, Zurn, Cambridge
- .7 Wall Hydrants\*
  - .1 Zurn; Ancon, RotoTech-Smith
- .6 Pressure Gauges\*
  - .1 Dresser; Morrison; Marshalltown; Marsh Hydropoise; H.O. Terrice, Weiss; Ashcroft
- .7 Thermometers\*
  - .1 Marshalltown; Johnson; Dressers; H.O. Terrice; Taylor; Weiss; Ametek

**.5 LIQUID HEAT TRANSFER:**

- .1 Welding fittings
    - .1 Grinnell; Crane; Tube ; Turn
  - .2 Welded pipe backing rings
    - .1 Robvon; Grinnell
  - .3 Malleable iron fittings flanges, flange gaskets
    - .1 Crane; Grinnell
  - .4 Mechanical joints\*
    - .1 Victaulic; Grinnell ; Gruvlock
  - .5 Vibration control\*
    - .1 Vibro-Acoustic; Airmaster; Vibron
  - .6 Expansion joints and flexible connectors\*
    - .1 Fulton; Flexonics; Yarway; Vibra; United
- 1.30 Appendix of Manufacturers CONT'D
- .7 Alignment guides\*
    - .1 Adasco; Flexonics; Fulton; Yarway
  - .8 Hangers and Supports
    - .1 Grinnell; Crane; Myatt
  - .9 Valves\*:
    - .1 Gate & globe
      - .1 Crane; Nibco; Toyo Type: Rising Stem
    - .2 Butterfly valves (Hot water only)
      - .1 Keystone
    - .3 Check valves (to be in the horizontal)
      - .1 Up to 50mm
        - .1 Crane; Nibco; Toyo
      - .2 64mm and up
        - .1 Check-Rite;
    - .4 Strainers\*
      - .1 Sarco-Canada; Toyo; Spirax/Sarco; Crane
    - .5 Balancing\* (Hot water only)
      - .1 B&G; Armstrong; Tour & Anderson
    - .6 Safety and relief\*
      - .1 Consolidated; Farris; Watts; Cash-Acme; Kunkle
    - .7 Radiator valves\*
      - .1 Crane; Dahl
    - .8 Backflow Preventers\*
      - .1 Wilkins/Zurn; Watts; Nebco
    - .9 Hose bibbs\*
      - .1 Wallaceburg; Crane; Emco
    - .10 Wall Hydrants\*
      - .1 Zurn; Ancon; Roto Tech Smith
  - .10 Air Separators\*
    - .1 Taco; Armstrong; B&G
  - .11 Pressure Gauges\*
    - .1 Morrison; Dresser; H.O.Terrice; Weiss; Marshalltown; Hydropoise; Marsh; Ametek
  - .12 Thermometers\*
    - .1 Dresser; H.O.Terrice; Taylor; Weiss; Marshalltown; Johnson
  - .13 Tank gauges\*
    - .1 Morrison; Penberthy
  - .14 Air vents\*
    - .1 Dole; Maid-O-Mist
  - .15 Venturi flow tubes\*
    - .1 Taco; Preso; Bell & Gossett; Armstrong
  - .16 Chemical treatment\*
    - .1 Betz Dearborn; Perolin; Bird-Archer; Accurate Treatment
  - .17 Tanks\*
    - .1 Expansion

- .1 Westeel-Rosco; Brown Steel
- .2 Bladder/Diaphragm expansion
  - .1 Amtrol; Taco
- .18 Unit Heaters:
  - .1 Engineered Air; Mc Quay; Trane
- .19 Wall fin, convectors, force flow, unit heaters\*
  - .1 Engineered Air; Mc Quay; Trane;
- .20 Pumps\*:
  - .1 In-line
    - .1 Taco; Armstrong; B & G; Grund-Foss
- .21 Boilers: Natural Gas
  - .1 Ray Pak
  
- .6 **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 Acoustic Duct Insulation
    - .1 JM; Fibreglass; Ultralite; Knauf
  - .6 Duct Sealer
    - .1 Duro-Dyne; 3M; United; Hardcast
  - .7 Louvres\*
    - .1 Aiolite; Air-O-Vent ; Penn; Airmaster; Canadian Advanced Air
- .7 **CONTROLS/INSTRUMENTATION:**
  - .1 Controls sub-contractor\*
    - .1 Johnson
  
- .8 **H.V.A.C. BALANCE & TESTING:**
  - .1 Air and Fluid Balances
    - .1 Air Movement & Mechanical Services; DFC, AHS

**PART 2 - SCHEDULES**

**TABLE 1 - REQUIRED SYSTEM INSTRUCTION**

| System Instruction  | Hours |
|---|-------|
| Plumbing  | 1     |
| Hydronic - Hot water heating (Includes controls)                  | 6     |
| Chemical Treatment – Hot Water Heating                            | 1     |
| Boiler Controls Only – Hot Water Heating: Initial heating season. | 6     |
| Boiler Controls Only – Hot Water Heating: Next heating season.    | 6     |

**TABLE 2 - REQUIRED SCHEMATIC SUBMITTAL**

| Required | System Schematic   |
|----------|--|
| ✓        | Plumbing   |
| ✓        | Hydronic - Hot Water Heating (Includes controls): Under Engineer's Seal c/w certification of installation. |
| ✓        | Controls   |

**TABLE 3 - REQUIRED SPARE PARTS**

| Required | Spare Parts  |
|----------|--|
| ✓        | Removable handles                                      |
| ✓        | Keys   |
| ✓        | Strainer Screens (4 sets)                              |
| ✓        | Side stream filter cartridge – One full heating season |

**TABLE 4 - THERMOMETERS - RANGE**

| System              | Temperature Range |           |
|---------------------|-------------------|-----------|
|                     | °C                | °F        |
| Hot water heating   | 0 to 115          | 30 to 250 |
| Domestic cold water | 0 to 16           | 30 to 60  |

**TABLE 5 - PRESSURE GAUGES - RANGE**

| System              | Pressure Range |        |
|---------------------|----------------|--------|
|                     | kPa            | Psi    |
| Hot water heating   | 0 - 517        | 0 - 75 |
| Domestic cold water | 0 - 517        | 0 - 75 |

**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              | 1/2   |
| 50                                 | 2     | 19              | 3/4   |
| 150                                | 6     | 30              | 1 1/4 |

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

| Pipe Marker Legend    | Valve Tag Legend | Primary Colour | Secondary Colour |
|-----------------------|------------------|----------------|------------------|
| Drinking water supply | D.W.S            | Green          | None             |
| Sanitary sewer        | SAN.S            | Green          | None             |
| HW Heating Supply     | H.W.H.S          | Yellow         | Black            |
| HW Heating return     | H.W.H.R          | Yellow         | Black            |
| Vent (plumbing)       | V.P              | Green          | None             |
| Make-up water         | M.U.W            | Yellow         | Black            |
| Natural Gas           |                  | Yellow         | Orange           |

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**PART 1 - GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

**1.2 WORK INCLUDED**

- .1 Chemical treatment of hot water heating system (new and existing).
- .2 Cleaning of hot water heating system (new and existing).
- .3 Provide clean softened water c/w report indicating solution parameters as installed after completion.
- .4 After Division 15600 has provided clean softened water for hot water heating system Division 15055 shall provide a report indicating solution parameters as installed after completion.
- .5 Site Visit at Commissioning stage c/w recommendations of procedure. Provide additional (1) mid winter season check c/w report and recommendations.
- .6 Provide a pot feeder and side stream filter arrangement with site glass at primary circulating pumps for system.

**1.3 RELATED WORK**

- .1 Division 15600 to provide assistance to clean and treat systems. See Division 15600 for description. Note if building circulating pumps are used, gaskets and seals are to be replaced. All strainer screens to be removed and replaced with new.

**1.4 QUALITY ASSURANCE**

- .1 Provide chemical treatment, chemicals and equipment by an agency that specializes in this type of work. Agency shall take full responsibility for providing suitable working systems.
- .2 Notify the Contract Administrator prior to commencing cleaning operation.

**1.5 SUBMITTAL**

- .1 Submit shop drawings including proposed chemicals, quantities and calculations, procedures and equipment to be supplied. Provide written operation instructions and system schematics.
- .2 Provide written report containing log and procedure of system cleaning giving times, dates, problems encountered and condition of water.
- .3 Submit written report containing results of tests and list of chemicals added every 14 days during temporary usage of treated systems.



**PART 2 - PRODUCTS****2.1 CHEMICALS**

- .1 Provide sufficient material to adequately treat systems for first year of operation of heating system.
- .2 Materials which may contact finish areas through leakage shall be colourless.
- .3 System Cleaner and Sludge Conditioner: Alkaline compound which in solution removes grease and petroleum.
- .4 Closed Systems Corrosion Inhibitor (Water): Sequestering agent to reduce deposits and adjust pH and corrosion inhibitor.

**2.2 EQUIPMENT**

- .1 Pot Feeder: 19 L capacity cast iron or welded steel with quick opening cap, with side stream filter c/w mounting bracket, T-Handle, 30 Micron filters and flow indicator.
  - .1 See Section 15010: Part 2, Schedule – Spare Parts

**2.3 TEST KITS**

- .1 Closed System Test Kit: To determine proper concentration of close system treatment, c/w log book.

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**PART 3 - EXECUTION****3.1 GENERAL**

- .1 Prevent debris, dirt and other foreign material from entering piping system during construction.
- .2 Division 15600 to provide drain connections to completely drain systems in one hour.
- .3 Division 15600 to provide water meter to record capacity in each system.
- .4 Division 15600 to remove strainer screens during cleaning. Terminal control valves shall be in open position during cleaning.
- .5 System pumps may be used for cleaning provided pumps are dismantled, inspected, worn parts repaired and new gaskets and seals installed. Turnover used seals.
- .6 System shall be operational, filled, started, and vented prior to cleaning.
- .7 Flush open systems for one hour minimum with clean water. Drain completely and refill.
- .8 Inspect, clean of sludge and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
- .9 Provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
  - .1 See Section 15010: Part 2 Schedule – Required Instruction.
- .10 Make call-back (1 mid winter) to check on procedures being followed and report call in writing to Contract Administrator, Section 15600 and The City of Winnipeg during first year's operation.
- .11 Guarantee all mechanical equipment provided to be free of defects for one year from date of substantial performance.
- .12 Provide a complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system. Four hard cover binders to be submitted to Contract Administrator for approval.
- .13 Contractor to witness cleaning of all strainers.
- .14 If any system is to be used for temporary heat, it is to be cleaned as outlined below prior to use of temporary heat and then cleaned again before takeover by the City and Contract Administrator. During temporary heat period system to be chemically treated under supervision and logs maintained on the chemical balances. Chemicals required during temporary heat period are to be in addition to the quantities required for the permanent operation.

**3.2 SYSTEMS CLEANOUT**

- .1 Hot water heating system to be cleaned out.
  - .1 A pump on each system may be used to circulate cleaning solution. Balancing valves on pump discharges to be regulated to ensure against operating pumps out of their normal operating range.
  - .2 Cleaner to be introduced by Division 15055 and circulated from 12 to 24 hours. System shall then be dumped by Division 15600.
  - .3 System to be flushed until conductivity of water in system is back to conductivity of make-up water.
    - .1 Conduct conductivity test before, during and after cleaning each system, and report procedures followed and conductivity readings to Contract Administrator and Contractor in writing.
  - .4 System to be refilled and required amount of chemical treatment added to provide immediate protection against corrosion.
  - .5 System not be used until cleaning procedure has been carried out supervised and signed off by the Contractor.

**3.3 SYSTEM TREATMENT**

- .1 Hot water heating system to receive system treatment.
  - .1 For corrosion control, systems to have corrosion inhibitor introduced through by-pass pot feeders installed after circulating pumps of each system under supervision of and according to shop drawings submitted by Contractor.
  - .2 Provide test kit, pot feeder and site glass with filter section on system.
  - .3 Provide corrosion inhibitor for system.

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**PART 1 – GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

**1.2 REFERENCES**

- .1 ASTM A167-89a, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .2 ASTM C411-82(1989), Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .3 CAN/ULC-S109-M88, Standard for Flame Test of Flame Resistant Fabrics and Films.
- .4 ANSI/NFPA 90A-1990, Air Conditioning and Ventilating Systems, Installation of.
- .5 ANSI/NFPA 90B-1989, Warm Air Heating and Air Conditioning Systems.
- .6 CGSB 51-GP-9M-76, Thermal Insulation, Mineral Fibre, Sleeving for Piping and Round Ducting.
- .7 CGSB 51-GP-11M-76, Thermal Insulation, Mineral Fibre, Blanket for Piping, Ducting, Machinery and Boilers.
- .8 CAN/CGSB-51.12-M86, Cement, Thermal Insulating and Finishing.
- .9 CAN/CGSB-51.40-M80, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.
- .10 CGSB 51-GP-52Ma-89, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .11 CGSB 51-GP-53M-77, Jacketing, PolyvinylChloride Sheet for Insulating Pipes, Vessels and Round Ducts.
- .12 CSA HA Series-M1980, CSA Standards for Aluminium and Aluminium Alloys.
- .13 ASTM C335-89, Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations.
- .14 CGSB 51-GP-10M-76, Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.

**1.3 WORK INCLUDED**

- .1 Labour, material, plant, tools, equipment and services necessary and reasonably incidental to completion of external insulation for mechanical equipment, piping and ductwork.

**1.4 RELATED WORK**

- |    |  |               |
|----|--|---------------|
| .1 | Mechanical General Provisions:               | Section 15010 |
| .2 | Plumbing:                                    | Section 15430 |
| .3 | Liquid Heat Transfer                         | Section 15600 |
| .4 | Heating/Ventilation and<br>Air Conditioning: | Section 15800 |

**1.5 QUALITY ASSURANCE**

- .1 All final pipe and duct installations including insulation, covering, and adhesive shall have a flame spread rating of not greater than 25 and maximum smoke developed rating of 50 in accordance with CAN4-S102. All canvas shall bear ULC label.
- .2 U.L.C. label or satisfactory certified report from approved testing laboratory is required to indicate that fire hazard ratings for material for use do not exceed those specified.
- .3 Flame proofing treatment subject to deterioration due to effects or high humidity are not acceptable.
- .4 Materials to be tested in accordance with ASTM C411.

**PART 2 – PRODUCTS**

**2.1 DESCRIPTION**

- .1 See Part 4 Insulation Schedule at end of this Division.

**PART 3 – EXECUTION****3.1 WORKMANSHIP**

- .1 Do not apply coverings until hydro-static tests have been completed, surfaces to be covered are clean and dry. Insulation shall be clean and dry when installed and during application of any finish.
- .2 Work shall be performed by licensed journeyman.
- .3 Apply insulation materials, accessories and finished in accordance with manufacturer's recommendations. (Joints to be on top).
- .4 Pack solid around all pipes where they pass through sleeves in walls, floor slabs, etc. for full thickness of floor and/or wall with fibreglass insulation. Where walls or floor slabs are used for rating purposes (See Section 15010 OPENINGS IN FIRE SEPARATIONS). Insulated pipes having vapour barrier jacket to pass through walls, floors, etc. to accommodate full insulation thickness. Protect insulation of exposed pipes passing through floors with 1.2mm (18 ga.) galvanized iron 150mm (6") from finished floor.
- .5 Vapour barriers and insulation to be complete over the full length of pipe or duct surface without penetration for hangers, standing duct seams and without interruption at sleeves, instruct duct installer. (See Section 15010 HANGERS + SUPPORTS).

**3.2 METHOD OF APPLICATION**

- .1 Fibreglass Piping Insulation:
  - .1 Fasten longitudinal laps with staples and seal with Swift Adhesive #3218.
  - .2 Butt joints wrapped with a 100mm strip of ASJ. Stagger joints multiple layers.
  - .3 Refinish exposed piping with brush coat Flintguard No. 120 white fire retardant lagging adhesive.
  - .4 All fittings 12mm (1/2") to 50mm (2") shall be insulated by wrapping with 25mm (1") thick layers of 13 kg/M3 density flexible fibreglass attached with jute twine, fittings 65mm (2 1/2") and over with preformed fittings. Surface shall be wrapped with Friction Tape and sealed with an asphaltic sealing compound. Over this to be applied a smooth coating of insulating cement. Recover fittings with ASJ vapour seal jacket and brush coat with fire retardant white lagging adhesive.
- .2 Flexible Duct Insulation:
  - .1 Rectangular ductwork:
    - .1 On ducts 305mm (12") wide and smaller apply fasteners on bottom surface of duct by impaling on welded pins on 305mm (12") centers.
    - .2 Spot adhesive on 305mm (12") centers on all sides of duct. Apply insulation with edges tightly butted together and secured with 100% coverage of 3-M No.17 or approved alternate. Staple joints and seal with 100mm strips of vapour barrier foil of same quality as duct insulation membrane sealed with BF 85-15.
  - .2 Round Ducts:
    - .1 Adhere to duct surface with adhesive applied in strips 152mm (6") wide, 305mm (12") o.c. Butt all edges of insulation, staple and seal all joints with tape adhered over the joint. Seal all breaks with vapour barrier tape. Recover ducts exposed to view with 170g canvas secured with Flintguard No. 120 white fire retardant lagging adhesive. Finish with brush coat of same adhesive.
- .4 Rigid Duct Insulation:



- 
- .1 Insulation applied with edges tightly butted and secured by impaling on pins welded to duct. Pins to be staggered, minimum 305mm (12") o.c. in every direction. This applies to all sides. Secure insulation to pins with metal fasteners. Pins shall be long enough to bend after fasteners have been applied. Install two fasteners to all insulation on roof. Dab adhesive over pins and fasteners.
  - .2 Seal all joints, edges and breaks in vapour seal jacket with vapour barrier foil of the same quality as that of duct membrane 100mm wide with BF-85-15 lagging adhesive.
  - .3 On ducts 610mm (24") wide and wider apply fasteners on bottom surface of duct by impaling on welded pins on 305mm (12") centers.
  - .4 Spot adhesive on 305mm (12") centers on all sides of duct. Apply insulation with edges tightly butted together and secured with 100% coverage of 3-M No.17 or approved alternate. Staple joints and seal with 100mm strips of vapour barrier foil of same quality as duct insulation membrane sealed with BF 85-15 lagging adhesive.
  - .5 On ducts 584mm (23") wide or less insulation applied as above but welded pins may be omitted.

**PART 4 - SCHEDULES**

**TABLE 8 - PIPE & DUCTWORK INSULATION**

| <b>System</b>                                | <b>Type</b> | <b>Remarks</b> |
|--|-------------|----------------|
| Piping – Domestic Cold, Hot                  | P-1         | A, B, E        |
| Piping – Hot Water Heating                   | P-1         | A, B, E        |
| Ductwork – Combustion Air Intake             | D-2 (2")    | A, E           |
| Ductwork – Combustion Air Ventilation: Patch | D-2 (2")    | A              |

**Remarks**

- A -** Unless otherwise noted, Insulate: (1) all new piping (2) all new ductwork, completely,
- B -** Repair existing insulation where connecting to new.
- E -** Boiler Room Apply over entire surface firm ULC listed heavy plain weave cotton fabric canvas at 220g/m<sup>2</sup> secured with Flintguard No. 120 white fire retardant lagging adhesive. Finish with brush coat of the same adhesive.

**Piping Material Legend**

- P-1** Preformed fibreglass heavy density full range with factory applied all service jacket. Cold water insulation to be c/w vapour barrier.  
**Domestic Water**
  - : Piping 25mm (1"Ø) & < (½") thick.
  - : Piping 31mm (1¼"Ø) to 50mm (2"Ø) 25mm (1") thick.
  - : Piping 62mm (2½"Ø) & > (2") thick.**Hot Water Heating**
  - : Piping 25mm (1"Ø) to 50mm (2"Ø) 25mm (1") thick.
  - : Piping 62mm (2½"Ø) and > 50mm (2") thick.
- P-2** Flexible fibreglass with vapour barrier 38mm (1½") thick 12Kg/m<sup>2</sup> density.

**Ductwork Material Legend**

- D-1** Rigid: heavy density full range fibrous glass insulation with factory applied re-enforced aluminium foil face vapour barrier.
- D-2** Flexible: 12Kg/m<sup>3</sup> density fibrous glass insulation with factory applied re-enforced aluminium foil face vapour barrier.

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**PART 1 - GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

**1.2 WORK INCLUDED**

- .1 All base plates (fabricated, using uni-strut) for pumps including placement of pumps to be installed with neoprene heavy density pads.
- .2 All pumps shall be installed with flex connections each side of pump.
- .3 Provide swing joints at each connection to existing for new supply and return hot water heating system.

**1.3 REFERENCE STANDARD**

- .1 Provide and install vibration isolation necessary to isolate and restrain mechanical equipment so that Average Noise Criteria Curves as outlined in the current ASHRAE Handbook are not exceeded.
  - .1 Vibration, Isolation
    - .1 Neoprene isolation shall be tested to ASTM specification stating "No.", minimum and maximum Tensile strength, minimum and maximum Elongation at break.

**1.4 SUBMITTALS**

- .1 Obtain relevant mechanical equipment information and provide shop drawings isolator locations, load on each isolator and installation instructions.
- .2 Drawings shall have the stamp and signature of manufacturer's technical representative.

**1.5 GENERAL REQUIREMENTS**

- .1 Vibration isolation equipment and materials shall be supplied by single Agent, except where isolators are factory installed on the exterior.

**1.6 INSPECTION**

- .1 Provide inspection services by vibration isolation equipment and materials manufacturer's representative after final installation and provide written report to the Contract Administrator that installation is in accordance with specifications and manufacturer's recommendations.

**1.7 ACCEPTABLE MANUFACTURERS**

- .1 Manufacturers whose product are approved in principle but subject to requirements of drawings and specifications are:
  - .1 Metraflex, Amber-Booth, Korfund, Vibro-Acoustics, Vibron, Industrial Acoustics Company.

## PART 2 - PRODUCTS

### 2.1 VIBRATION ISOLATORS

- .1 Neoprene Pads: (VI - 3)
  - .1 Provide physical properties, ageing tests, compression set, low temperature limits, tear test bath oil and oven.
  - .2 Where a ribbed pad is used, the height of the ribs shall not exceed 0.7 times the width of the rib. Steel inter-layers shall be used to distribute the load in a multi-layered unit.

### 2.2 FLEXIBLE PIPE CONNECTIONS

- .1 Pipe Connections: (FPC- 1)
  - .1 (Type FPC - 1)
    - .1 Flexible pipe connector shop drawing data shall include maximum allowable temperature and pressure rating, overall face-to-face length 456 mm (18") long unless otherwise noted, live length, hose wall thickness, hose convolutions per unit length and per assembly, fundamental frequency of assembly braid structure and total number of wires in braid.
    - .2 Construct with stainless steel inner hose and braided exterior sleeve for steel piping.
    - .3 Construct with bronze inner hose and braided exterior sleeve for copper piping.
    - .4 No steel wires or rings shall be used as pressure reinforcement.
    - .5 Use connectors suitable for minimum 862 kPa (125 Psi) WSP and 232<sup>0</sup>C (450<sup>0</sup>F), and 1380 kPa (200 Psi) WOG and 121<sup>0</sup>C (250<sup>0</sup>F) flanged of NPT.

### 2.3 EXPANSION COMPENSATORS

- .1 Construction: Expansion Loop

### 2.4 PIPE ALIGNMENT GUIDES

- .1 Construction:
  - .1 Carbon steel with painted finish.
  - .2 Saddle base with pre-drilled holes.
  - .3 Internal retainer pre-insulated (bolted) with exterior swivel top bolted one side or bolted both sides.
  - .4 Maximum movement 76mm (3")

**PART 3 - EXECUTION**

**3.1 EXPANSION COMPENSATORS**

- .1 Installation of piping loop to be as recommended by Division 15205 technical representative c/w written report.

**3.2 PIPE ALIGNMENT GUIDE**

- .1 Installation of pipe alignment guides relative to piping loop to be as recommended by Division 15205 technical representative c/w written report.

**PART 4 - SCHEDULES**

TABLE 9 - VIBRATION ISOLATION & ATTENUATION

| Equipment Mark           | Base Mount | Spring Hung | Neoprene | Flex Connection |   | Anchor Alignment Guide | Remarks |
|--------------------------|------------|-------------|----------|-----------------|---|------------------------|---------|
|                          |            |             |          | D               | P |                        |         |
| Pump (PU-1 and PU-2)     | ✓          |             | ✓        |                 | ✓ |                        | A       |
| Hot Water Heating Piping |            |             |          |                 |   | ✓                      | B       |

**Remarks**

- A - Provide uni-strut base mount assembly for pump placement. Place pumps on neoprene pads at contact points.
- B - See Part 3 above.

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**PART 1 - GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

**1.2 REFERENCE**

- .1 ANSI B16.18-1984, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ANSI B16.22-1980, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .3 ANSI B16.24-1979, Bronze Pipe Flanges and Fittings, Class 150 and 300.
- .4 MSS-SP-80-1979, Bronze Gate, Globe, Angle and Check Valves.
- .5 ASTM B32-89, Specification for Solder Metal.
- .6 ASTM B306-88, Specification for Copper Drainage Tube (DWV).
- .7 CAN/CSA-B125-M89, Plumbing Fittings.
- .8 CAN/CSA-B45 Series-88, CSA Standards on Plumbing Fixtures.
- .9 CAN3-B79-M79, Floor Drains and Trench Drains.
- .10 PDI-WH201-77, Water Hammer Arrestors.

**1.3 WORK INCLUDED**

- .1 Modify existing domestic water supply for boiler feed make-up.
- .2 Modify existing sanitary system at Basement to provide drainage for boiler system.
- .3 Modify existing natural gas piping system to suit new connected load.
- .4 All drips and relief piped to drain. Provide containment pail at low water cut off for testing.
- .5 Existing back flow prevention to be re-used, new PRV water make-up valve to be installed.

**1.4 RELATED WORK SPECIFIED ELSEWHERE**

- .1 Mechanical General Provisions: Section 15010
- .2 Insulation: Section 15100
- .3 Electrical General Provisions: Section 16000

---

**PART 2 - PRODUCTS****2.2 PIPE AND FITTING**

- .1 General: Pipe and fittings shall conform to the standard listed in the applicable Building Code (latest Revision).
- .2 Water:
  - .1 Domestic Water System Above Ground:
    - .1 Piping:
      - .1 Type L Copper to ASTM B88M.
      - .2 Solder/brazing:
        - .1 Lead Free to suit application. 12mm  $\varnothing$  (1/2"  $\varnothing$ ) – 50mm  $\varnothing$  (2"  $\varnothing$ )
    - .2 Fittings/Joints:
      - .1 Bronze Flanged joints must have suitable gasket and bolts:
        - .1 Class 150 and 300 to ANSI B-16.24
      - .2 Cast bronze flanges and fittings:
        - .1 Class 125 and 250 to ANSI B16.15
      - .3 Cast bronze threaded fittings solder type pressure fittings:
        - .1 ANSI B16.18
      - .4 Wrought copper and copper alloy solder joint pressure fitting:
        - .1 ANSI B16.22
      - .5 Use brass nipples between copper piping and flush valves or c.p. brass goods.
      - .6 Where alternate piping materials or jointing area specified a uniform type of pipe and fittings shall be used throughout each system.
      - .7 Bolts, nuts, hex head and washer:
        - .1 ASTM A 307, heavy series.
  - .3 Drains and Vents:
    - .1 Drains and vent pipes shall be in accordance with local or provincial regulations with the following exceptions, unless otherwise specified.
      - .1 Effluent Gravity:
        - .1 Piping:
          - .1 All cast iron soil pipe shall be class 4000:
            - .1 CAN3-B70
        - .2 Fittings/Joints:
          - .1 Gaskets:
            - .1 ASTM C564
          - .2 Mechanical joint couplings shall have a corrugated stainless steel sleeve over the joint with stainless steel worm drive securing bands tack welded to the sleeve were exposed.
            - .1 Titan, St. Croix
          - .3 Wrought copper vent type DWV:
            - .1 ASTM B 306.
          - .4 Cast Brass:
            - .1 CAN/CSA B 125.
          - .5 Wrought copper:
            - .1 CAN/CSA B 125.
    - .4 Natural Gas
      - .1 In accordance with CAN1-B149.1 M- Latest Edition.
      - .2 Piping:
        - .1 Steel to ASTM A120 Sch. 40 seamless as follows:

- 
- .1 Up to 50 mm  $\varnothing$  (2"  $\varnothing$ ) screwed
  - .2 63 mm  $\varnothing$  (2 1/2"  $\varnothing$ ) and up plain end
  - .3 Fittings:
    - .1 Screwed: CGA approved gas tape on joints.
    - .2 Welded fittings: to CSA W47.1
      - .1 Malleable iron screwed fittings (banded): Class 150 to ANSI B16.3
      - .2 Steel butt-welding fittings: to ANSI B16.9
      - .3 Unions, malleable iron, brass to iron, ground seat: to ANSI B16.3
      - .4 Bolts and nuts: to ANSI B18.2.1 and ANSI B18.2.2
      - .5 Nipples, Schedule 40: to ASTM A53
    - .3 Purge after pressure test in accordance with CAN1-B149.1-M – Latest Edition.

### 2.3 VALVES

- .1 General:
  - .1 Valve parts must be of a material recommended for the service. All valves must be installed with the stems upright or horizontal, not inverted. Any valves not specifically covered herein shall be of comparable quality to those specified.
- .2 Domestic Cold:
  - .1 Gate valves:
    - .1 Up to 50 mm  $\varnothing$  (2"  $\varnothing$ ):  
MSS SP-80 Class 125, 860 kPa bronze body to ASTM B32 Alloy Grade 95TA, non rising stem, screwed over bonnet, solid wedge disc, solder joint ends.
      - .1 Crane, Nibco, Toyo
- .3 Natural Gas:
  - .1 Manual shut-off of the plug, ball or eccentric type.
    - .1 Shall not be subjected to either a temperature or pressure greater than is certified rating.
  - .2 Pressure reducing: Confirm with supplier pressure system will operate at as well as where reduction may be introduced into the system.
    - .1 Tight shut off is a requirement of all regulators.
    - .2 Sized for maximum of 60% of full rated capacity.
    - .3 Regulator connections shall be no smaller than half the pipe size serving the regulator.
    - .4 Pressure relief to protect each regulator from an over pressure condition.
    - .5 Relief valves may be throttling type or pop relief unless otherwise dictated by Code.
    - .6 Internal relief casing vents must be piped separately to outdoors.
    - .7 Materials:
      - .1 Bodies: Cast iron, bronze and steel.
      - .2 Diaphragm: Nitrile, neoprene and stainless
      - .3 Packing: TFE where applicable.
        - .1 Fisher, Canadian Meter.

### 2.4 WATER PRESSURE REGULATOR

- .1 Bronze body construction:
  - .1 Adjustable setting 172 kPa (25 Psi) to 516 kPa (75 Psi)
  - .2 Renewable stainless steel seat
  - .3 Stainless steel integral strainer
  - .4 High temperature resisting nylon insert diaphragm for hot or cold water.
  - .5 Gauge tapping and gauge

---

**PART 3 - EXECUTION****3.1 GENERAL INSTALLATION**

- .1 All pipe shall be cut accurately to measurements taken at the site and shall be installed without springing or forcing. All changes in direction shall be made with fittings.
- .2 All connections to equipment shall be made with unions or flanges.
- .3 Valve working parts shall be removed during installation to prevent damage from heat where brazing, soldering or welding is used.
- .4 Comply with C.S.A. Standard W117.2 "Code for Safety in Welding and Cutting".
- .5 All piping in accessible pipe spaces shall be run in such a way that it does not interfere with free access into the pipe space.

**3.2 WATER SUPPLY SYSTEM**

- .1 Install shut off valves at all connections to major pieces of equipment, and in all branches to fixtures or groups of fixtures.
- .2 Install dielectric insulating couplings between all pipes or apparatus constructed of dissimilar metals. Use brass nipples at flush valves, etc.
- .3 Install pressure gauge each side of back flow preventer.

**3.3 JOINTS**

- .1 All joints shall be made in accordance with manufacturer's recommendations.

**3.4 TESTING**

- .1 All piping systems shall be pressure tested as follows:
  - .1 Plumbing and drainage system (*new*) - in accordance with local regulations.
  - .2 Water supply piping - test with water to 690 kPa (100 Psi) at the highest point of the system. Maintain pressure without loss for 4 hours. Contractor to witness and sign off.
- .2 General:
  - .1 All systems and equipment will be subject to operating tests to verify that they operate properly as directed by the Contract Administrator.
  - .2 The Contract Administrator's representative shall witness tests. Give 48 hours notice in advance of all tests. All tests shall be witnessed by the Contractor with written confirmation.

**PART 4 – SCHEDULES**

TABLE 10 - PLUMBING FIXTURES

| Mark    | Description  |
|---------|--|
| (WPR-1) | Water Pressure Regulator:<br>Zurn. Size: (1/2").                                       |
| (HWT-1) | Hot Water Tank:<br>AO Smith DVE-80-12, 12 Kw, 80 gallon, 3, elements, 49 gph at 100 F. |

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**PART 1 - GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

**1.2 REFERENCES**

- .1 ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
- .2 ANSI/ASME B16.3, Malleable Iron Threaded Fittings, Classes 150 and 300.
- .3 ANSI B16.5, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
- .4 ANSI/ASME B 16.9, Factory Made Wrought Steel Butt Welding Fittings.
- .5 ANSI B18.2.1, Square and Hex Bolts and Screws.
- .6 ANSI/ASME B18.2.2, Square and Hex Nuts.
- .7 ANSI/AWWA C111/A21.11, Rubber Liquid propaneket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- .8 ASTM A47M, Specification for Ferritic Malleable Iron Castings.
- .9 ASTM A53, Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
- .10 ASTM A536, Specification for Ductile Iron Castings.
- .11 ASTM B61, Specification for Steam or Valve Bronze Castings.
- .12 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .13 ASTM E202, Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .14 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .15 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
- .16 CSA W47.1S1-M10, Supplement No. 1-M1989, Steel Fixed Offshore Structures to W47.1-1983.
- .17 MSS-SP-67, Butterfly Valves.
- .18 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .19 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- .20 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .21 MSS-SP-85, Cast Iron Globe and Angle Vales, Flanged and Threaded Ends.

**1.3 SCOPE OF WORK**

- .1 Provide labour, materials, plant, tools, equipment and services necessary for and reasonably incidental to completion of:

- .1 Removal of existing steam heating system: boiler c/w all controls (includes existing chimney arrangement within Boiler Room and up through roof), condensate unit c/w all controls, all associated steam and condensate piping, pumps, valving and steam heating equipment. Note to include existing steam to water heat exchanger system, piping, valving, associated control.
  - .1 Where existing element/cabinet/force flow is steam, change out valving minor piping and control only to: hot water heating, pneumatic control where applicable or Danfoss. Make allowance for twelve pieces of different equipment: Controls sub-contractor.
- .2 Hot water heating system: boilers, pumps, expansion tank, air separator, unit heater, valves and piping, softened water. Note existing boiler pad to be re-used and extended as noted.
- .3 Hot water heating system: All asbestos removal work by City of Winnipeg.
- .4 Provide services of a controls sub-contractor under Engineer's Seal to provide shop drawings and certification of control system installation c/w full commissioning of the boiler package control system as provided by the controls sub-contractor (include all conduit, wiring and devices): switch over capability from indoor/outdoor control to adjustable fixed temperature setting, high low limit with alarm, lead lag operation of: (1) primary circulating (each-two) pumps, (2) (each-three) boilers, alternating with pump status, flow switches, (control circuits provided by Div. 16), unit heaters to start stop only (wired by Div.16). See item #5 below for additional requirements for method of wiring.
- .5 In conjunction with Controls sub-contractor: Provide cost of device, installation of and for tying this new installation into the existing City monitoring system: (1) low temperature, (2) primary heating pumps status, pump start/stop, (3) each boiler flow switch status (4) boiler low water shut down, (5) Boiler Supply Water Temp, each boiler, (6) Boiler Return Water Temp, each boiler, (7) Supply Water after the pumps to the loops, (8) Boiler Start/Stop (Typical of three), (9) Boiler Status (Typical of three) from the boiler package controls, (10) Boiler Alarm (Typical of three) from the boiler package controls, (11) Outdoor Air Temp
- .6 Assist chemical treatment supplier: Provide drain ports for flushing of system. Note if building new circulating pumps are used, gaskets and seals are to be replaced.
- .7 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,

#### 1.4 RELATED WORK SPECIFIED ELSEWHERE

- .1 Insulation: Section 15100
- .2 Plumbing: Section 15430



**PART 2 - PRODUCTS****2.1 PIPE AND FITTINGS**

- .1 Pipe: Steel
  - .1 19mm (3/4") to 150mm (6"):
    - .1 Schedule 40, black steel pipe conforming to CSA Standard B63, ASTM A53, Grade B.
- .2 Fittings: Steel
  - .1 Screwed fittings:
    - .1 Malleable iron, to ANSI/ASME B16.3, Class 150
  - .2 Pipe flanges and flanged fittings:
    - .1 Steel: to ANSI/ASME B16.5
  - .3 Butt welding fittings:
    - .1 Steel, to ANSI/ASME B16.9
  - .4 Unions:
    - .1 Malleable iron, to ASTM A47M and ANSI/ASME B16.3

**2.2 VALVES**

- .1 Valves shall be of one manufacture. Submit brochure of valves selected, showing make, figure numbers and use.
- .2 Gate Valves: Steel
  - .1 Up to 682 kPa (100 Psi):
    - .1 Up to 50mm (2") screwed ends
    - .2 Over 50mm (2") flanged ends
      - .1 Rising stem:
        - to MSS SP-80, Class 125, 860 KPa. Bronze body solid wedge disc.
          - .1 Crane, Nibco, Lunkenheimer, Toyo
      - .2 Non rising stem:
        - to MSS-70, Class 125, 860 kPa, cast iron body, bronze trim, bolted bonnet.
          - .1 Crane, Nibco, Lunkenheimer, Toyo
  - .2 Over 682 kPa (100 Psi):
    - .1 Up to 50mm (2") screwed ends
    - .2 Over 50mm (2") flanged ends
      - .1 Rising stem:
        - to MSS SP-80, Class 300, 2068 kPa. Bronze body solid wedge disc.
          - .1 Crane, Nibco, Lunkenheimer, Toyo
      - .2 Non rising stem:
        - to MSS-80, Class 250, 1723 kPa, cast iron body, bronze trim, bolted bonnet.
          - .1 Crane, Nibco, Lunkenheimer, Toyo
- .3 Butterfly Valves: Steel
  - .1 63 mm (2-1/2") and over, lug body
    - .1 To MSS SP-67, Class 150, 1 MPa WOG, cast iron disc, stainless steel stem replaceable seat, locking handle.
  - .2 Operators:
    - .1 63 mm (2-1/2") and over:
      - .1 Locking type lever handle.
        - .1 Centreline, Keystone, Lunkenheimer, Nibco, Toyo,
    - .2 152 mm (6") and over:
      - .1 Gear operator.
        - .1 Centreline, Keystone, Lunkenheimer, Nibco, Toyo

- .4 Globe Valves: Steel
  - .1 Up to 682 kPa (100 Psi):
    - .1 Up to 50mm (2") screwed ends
    - .2 Over 50mm (2") flanged ends
      - .1 To MSS SP-80, Class 125, 860 kPa. Bronze body screwed over bonnet, composition disc suitable for service.
        - .1 Crane, Nibco, Lunkenheimer, Toyo
  - .2 Over 682 kPa (100 Psi):
    - .1 Up to 50mm (2") screwed ends
    - .2 Over 50mm (2") flanged ends
      - .1 To MSS SP-85, Class 250, 1723 kPa. Cast iron body, bronze trim, OS+Y, bolted bonnet, bronze disc and seat ring.
        - .1 Crane, Nibco, Lunkenheimer, Toyo
- .5 Ball Valves: Brass
  - .1 Up to 50mm (2") screwed ends
    - .1 To ASTM B62, 4 MPa WOG, bronze body, screwed ends, TFE seal, hard chrome solid ball, teflon seats and lever handle.
      - .1 Toyo, Nibco.
- .6 Swing Check Valves: Steel
  - .1 Up to 50mm (2") screwed ends:
    - .1 To MSS SP-80, Class 125, 860 kPa bronze body, bronze swing disc, screw in cap, regindable seat.
      - .1 Toyo, Crane, Jenkins, Lunkenheimer, Nibco
  - .2 Over 50mm (2"), flanged:
    - .1 To MSS SP-71, Class 125,860 kPa cast iron body, FF flanged, grooved, renewable seat, bronze disc, bolted cap.
      - .1 Toyo, Crane, Jenkins, Lunkenheimer, Nibco
- .7 Silent Check Valves: Steel
  - .1 Up to 50mm (2"):
    - .1 To ASTM B62, Class 125,860 kPa, cast steel, wafer style, brass seat rings, brass inner valve, stainless steel spring, heavy duty spring in vertical down flow application.
      - .1 Kitz, Toyo, Crane, Lunkenheimer, Nibco
  - .2 Over 50mm (2"):
    - .1 Class 125,860 kPa, cast steel, wafer style, bronze trim, stainless steel spring, heavy duty spring in vertical down flow application.
      - .1 Kitz, Toyo, Crane, Lunkenheimer, Nibco
- .8 Lubricated Plug Cocks: Steel
  - .1 Up to 50mm (2") screwed ends:
    - .1 To ASTM B61, Class 150, 1 MPa, bronze body.
      - .1 DeZurk, Mueller
- .9 Strainers: Steel
  - .1 Strainers shall be type Sarco "YS" for sizes up to and including 50mm (2") screwed ends.
  - .2 On pipe sizes 63mm (2 1/2") and larger, use std. type "D" for systems operating below 689 kPa (100 Psi) and use extra heavy type "D" for systems operating at 689 kPa (100 Psi) and above.
  - .3 Screens shall be stainless steel with perforations as follows:
    - .1 Heating (except pump suctions) - 1.6mm.
    - .2 Pump Suctions - 3.17 mm.

- .3 Provide one set of spare screens for strainers ahead of pumps.
- .4 Provide Sarco "Y" type pipe strainers in the following locations and where shown on the drawings:
  - .1 Pressure reducing valves.
  - .2 Pump suction.
- .10 Balancing Valves: Steel
  - .1 Circuit Setter:
    - .1 Circuit Y style globe valve with valved ports for connecting to differential pressure meter. Readout to be within plus or minus 2% of actual flow at design flow rate. Drain connection to be valved 19 mm (3/4") and capped suitable for hose socket to be incorporated into the valve body or provided as separate item.
    - .2 Up to 50 mm (2"):
      - .1 Maximum WP: 1723 kPa (250 Psi); maximum temperature: 121<sup>0</sup>C (250<sup>0</sup>F), Pressure die-cast zinc desincification resistant copper alloy (Ametal), stainless steel construction; Teflon disc, screwed in bonnet screwed ends. Flow control with digital hand wheel and tamperproof concealed mechanical memory.
        - .1 B&G, CB 1/2 -CB2, CB4F - CB8F, Armstrong, CBVS, CBVI, Tour and Anderson.
    - .3 Over 50mm (2"):
      - .1 Maximum WP: 1723 kPa (250 Psi); maximum temperature: 121<sup>0</sup>C (250<sup>0</sup>F), Body and Epoxy resin coated cast iron: bonnet and trim of zinc dezincification resistant copper alloy (Ametal); bonnet bolts of stainless steel, ANSI Class 125 flanged ends. Flow Control handwheel with vernier type ring settings and tamperproof concealed mechanical memory.
        - .1 B&G, CB 2 1/2F-CB8F, Armstrong, CBVII, Tour and Anderson
- .11 Radiator Valves: Steel
  - .1 Globe Type:
    - .1 To MSS SP80, Class 125 860 kPa screwed in bonnet, swivel type metal disc and screwed ends.
  - .2 Angle Valve:
    - .1 To MSS SP-80, CLASS 175, 1260 kPa, 2 piece body, blow off proof stem, screwed ends.
- .12 Drain Valves: Steel
  - .1 Sediment hose faucet c/w brass cap and chain at base all risers and where noted on plans.
    - .1 Kitz Type 58CC.

### 2.3 ANCHORS

- .1 Provide on horizontal piping. Fit anchors on vertical piping to ensure that water or air is not trapped. Fabricate from channels and angles to suit location; brace to building structure.
- .2 To accommodate specified thickness of insulation. Vapour barriers and jackets to remain uninterrupted. (See Section 15205 GENERAL REQUIREMENTS).

### 2.4 GUIDES

- .1 Pipe guide assembly to direct pipe movement along a longitudinal axis, consisting of:
  - .1 A 4 finger "spider" inside a guiding sleeve formed of two halves suitable for clamping into pipe.

- .2 A guiding sleeve formed of two parts suitable to be bolted to supporting structure. (See Section 15205 GENERAL REQUIREMENTS).

## 2.5 AIR VENTS

- .1 On each water fed unit convector and forced flow unit, key-operated air vent rated at 1034 kPa (150 Psi), complete with copper tube extensions carried through ends of wall hung cabinets, or through fronts of recessed cabinets.
- .2 On wall fin sections with standard and special cabinets, key operated air vent rated at 1034 kPa (150 Psi) with copper tube extensions with screwdriver operated air vent rated at 1034 kPa. (150 Psi).
- .3 Install at system high points, where air may be trapped and where noted (Unit Heater), Manual air vents.
- .4 Automatic Air Vents:
  - .1 Standard float vent:
    - .1 Brass body and vent, 3.17mm (1/8") connection and rated at 690 kPa (100 Psi) working pressure.
      - .1 Amtrol, Armstrong, Braukman
    - .2 Industrial float vent:
      - .1 Cast iron body, 12mm (1/2") connection and rated at 860 kPa (125 Psi) working pressure.
        - .1 Amtrol, Armstrong, Braukman, Maid-O-Mist, Taco
    - .3 Float:
      - .1 Solid material suitable for 115°C (240°F) working temperature.

## 2.6 EXPANSION COMPENSATION

- .1 Provide equipment required to control expansion and contraction of piping, with pipe loops, pipe offsets, swing joints. (See Section 15205 SUBMITTALS).
- .2 Expansion joint shop drawings shall include maximum allowable temperature and pressure rating, and maximum expansion compensation.
- .3 Base expansion calculations on 10<sup>0</sup>C (50<sup>0</sup>F) installation temperature to 3.8 times actual operating temperature.

## 2.7 AIR SEPARATOR

- .1 Furnish and install as shown on plans an external air separation unit consisting of a steel tank.
- .2 The unit shall have flanged inlet and outlet connections and strainer removal connection. The removable strainer shall be of stainless steel with .05 mm (3/16") diameter perforations and a free area of not less than five times the cross-sectional area of the connecting pipe. Remove and clean strainer after 24 hours operation and after 30 days operation.
- .3 Unit shall have separate top fittings for connection to system expansion tank and for air vent.
- .4 There shall be a bottom connection for blow down cleaning.
- .5 Unit must be constructed in accordance with the ASME boiler and pressure vessel code and stamped 861 kPa (125 Psig) design pressure.

## 2.8 EXPANSION TANKS

- .1 Bladder/Diaphragm:

- .1 Shell:
  - .1 Fabricated Steel Designed and Constructed per ASME Section VIII. Div. 1.
- .2 Air chamber:
  - .1 Heavy duty butyl diaphragm bonded with polypropylene liner to steel shell, separating air chamber from water suitable for glycol use.
- .3 Bladder/Diaphragm Full Acceptance:
  - .1 Bladder to be removable for inspection.
- .4 Air side charge connection, water side inlet connection.
- .5 862 kPa (125 PSIG)

## 2.9 UNIT HEATERS

- .1 Water ratings based on 82.2°C (180°F) supply water, average -6.6°C (20°F) temperature drop.
- .2 Vertical Unit Heater:
  - .1 General
    - .1 Casing 1.6mm thick steel with rounded exposed corners and edges, threaded connections for hanger rods.
  - .2 Coils
    - .1 Seamless copper tubing, silver brazed to steel headers and with evenly spaced aluminum fins mechanically bonded to tubes. Hydrostatically tested to 1Mpa.
  - .3 Fans
    - .1 Direct drive propeller type, factory balanced with anti-corrosive finish.
  - .4 Motor
    - .1 Continuous duty, ball bearing motor with built-in over load protection and resilient motor supports.
  - .5 Air Outlets
    - .1 Adjustable multi-vane diffuser with finish to match casing.
  - .6 Control
    - .1 Low limit aquastat strapped on to supply set to prevent fan operating below 27°C.
    - .2 Low voltage thermostat, locking cover, concealed adjustment with brushed aluminum cover and guard by contractor.

## 2.10 PUMPS

- .1 General:
  - .1 Provide factory authorized start up.
  - .2 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.
  - .3 Provide coupling guards on all pumps.
  - .4 Submit with shop drawings, certified pump curves. Pump impeller not to exceed 85% of maximum impeller diam.
  - .5 Mount on cast iron or heavy steel base, having drip lips and tapped drainage holes. Provide air cock on each pump.
  - .6 Provide spool pieces on pump suction and discharge for fittings of vibration isolators. To be 457 mm (18") long for piping up to and including 50mm (2") and 610mm (24") long for piping 63mm (2 1/2") and above.
- .2 Vertical In-Line Circulating Pump:

- .1 In-line circulating pumps of iron body standard construction suitable for working pressure of 862 kPa. Shafts to have integral thrust collar, supported by two oil lubricated bronze sleeve bearings. Watertight arm seal long life mechanical seals.
- .2 Provide 1.0mm galv. iron pan with 25mm (1") high edges under all pumps located in ceiling spaces. Pans shall have all seams and joints soldered to be watertight.

## 2.11 NATURAL GAS BOILER

- .1 Copper Tube :
  - .1 Staged firing control of the gas input to the boiler.
    - .1 Natural Gas Burner:
      - .1 The tube burners shall have multiport radial gas orifices, ports, and slots for pressure balance, be capable of quiet ignition and extinction without flashback at the orifice, and be manufactured from a corrosion resistant titanium, chrome, and stainless steel alloy with low expansion coefficient.
      - .2 The burners will be supplied with a fan assisted, clean burning, highly efficient fuel-air mixture. The boiler(s) shall comply with all local and national air quality regulations for low NOx boilers and shall emit less than 20 PPM NOx emissions, depending on combustion air quality and fuel composition.
    - .2 The boiler(s) shall be equipped with 100% safety shutdown.

The ignition shall be Hot Surface Ignition type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence, to ensure consistent operation. The igniter will be located away from the water inlet to protect the device from condensation during startup.
    - .3 External viewing ports shall be provided, permitting visual observation of burner operation from both ends of the boiler.
  - .2 The boiler shall be design certified and approved by CGA, ASME inspected and stamped complete with manufacturer's data report.
  - .3 The boiler shall be equipped with a 60 PSI ASME pressure relief valve.
  - .4 The water tube heat exchanger shall be of a horizontal grid design constructed with nine (9) 1" x .065" wall integral copper fin tubes with fin spaces at seven fins per inch and extra heavy galvanized steel "V" baffles secured tightly to the tubes above the point of tangency of the fins. Each end of the tubes shall be rolled up into an ASME fire box steel tube sheet and sealed to cast headers with silicone 'O' rings with a temperature rating over 260°C (500°F). The heat exchanger shall have a maximum working pressure of 1103 kPa (160 Psi) and be factory tested to a hydrostatic pressure of 2578 kPa (400 Psi).
  - .5 The headers shall be secured to the tube sheet by properly spaced stud bolts and flange nuts.
  - .6 The heat exchanger shall be readily cleanable from either the right or left sides of the boiler and on one side cleanable without removing external piping. The heat exchanger shall be explosion proof on the water side.
  - .7 Boiler Control
    - .1 The boiler(s) shall be equipped with an operating temperature control and high limit control.
    - .2 A flow switch, mounted and wired shall be provided as standard.
    - .3 The boiler(s) will be equipped with an energy-saving pump control relay (Economaster 11),

Mounted and wired, which automatically shuts off the boiler pump at a set period after boiler shut-down (adjustable from three to ten minutes) to avoid standby losses associated with constant pump operation.

- .8 Gas Train
  - .1 The boiler(s) will have a CSD-1 firing/leak test valve and pressure test valve.
  - .2 The boiler(s) will have dual seated main gas valve(s).
  - .3 All gas control trains must have a redundant safety shut off feature, main gas regulation, shut off cock and plugged pressure tapping.
- .9 The boiler shall be furnished low profile built-in draft diverter.
- .10 The boiler controls and main electric natural gas valve shall be 24VAC except when motorized valves are specified. A suitable 110/24 volt transformer shall be factory installed and wired.
- .11 The boiler shall be equipped with an automatic reset adjustable secondary electric high limit with a maximum setting of 225<sup>0</sup>F.
- .12 The boiler is to shut down when thermostat(s) is satisfied and not fire during standby in order to reduce operating costs caused by standby loads and radiation losses. Circulation is required whenever boiler is fired.
- .13 The boiler is to be capable of operating down to 105<sup>0</sup>F without sustaining condensation.
- .14 The boiler shall be CGA tested for a minimum efficiency of 84% in accordance with CGA Interim Requirement No. 10.
  - .1 ASME required instruments, fittings and controls including the following:
    - .1 ASME rated relief valve set to release entire boiler capacity.
    - .2 4 in dial water pressure gauge, range 0 to 75 psi.
    - .3 4 in dial thermometer gauge, range 40 to 250 deg F.
    - .4 Manual shut-off valve, manual firing valve, pilot valve, natural gas pressure regulator, 110/24 volt transformer, electric adjustable high limit control.
    - .5 Model T: modulating burners. High limit control stops burner at 220 deg F.
    - .6 Raypak Sequence Pak B6000
    - .7 Two low water cutoffs.
    - .8 Two high limits.
  - .2 Boiler Diagnostics
    - .1 The boiler(s) shall be equipped with an external LED panel displaying following boiler status/faults
      - .1 Power on
      - .2 Safety fault
      - .3 Call for heat
      - .4 Ignition fault
      - .5 Flow proven
      - .6 Stages 1, 2
      - .7 Fan 1 proven
    - .2 An internal circuit board indicating the following safety faults by LED signal:
      - .1 System enabled
      - .2 Manual reset hi-limit
  - .3 Manual-automatic selector switch shall permit manual or automatic firing at any rate.

- .15 Provide factory authorized site start up c/w report. Boiler supplier, contractor shall be on site to verify control over boiler. Include for a second mid-season service check make adjustments as required and submit mid-season report.



**PART 3 - EXECUTION****3.1 PIPING GENERAL**

- .1 The inside of all pipe fittings, valves and all other equipment to be smooth, clean and free from blisters, loose mill scale, sand and dirt when erected.
- .2 Install unions or flanges at all equipment connections, valves, etc.
- .3 Pipe bending other than wrought iron, permitted only if seamless steel pipe is used without distortion, rippling and reduction in wall thickness. Contract Administrator reserves right to have pipe sections replaced with fittings if bending is not satisfactory.
- .4 Up to and including 50mm (2") to be screw jointed with screwed fittings. Make screw joints iron to iron, with graphite and oil filler or joint compound. Dope male threads only. Use brass to iron ground joint unions. Screwed fittings on steel pipe to be best quality 1034 kPa (150 Psi) black malleable iron banded. Nipples to suit type. On high pressure steam and condensate lines screwed fittings to be best quality 2068 kPa (300 Psi) black malleable iron banded. Nipples to suit schedule 80 pipe.
- .5 63mm (2 1/2") and above to be jointed by welding. Branch connections to be welded using Crane butt welding fittings, manufactured to ASTM a-234. Use Grinnell forged carbon steel slip-on welding flanges, welded to pipe on which they are fitting, at flange neck and back-welded on pipe end, at inside flange face. Valve companion flanges to be flat or raised face, matching valve flange. Flanges to conform to ASTM A181, Grade 1. Use Cranite preformed asbestos liquid gaskets on flanged joints. Site or shop cut liquid gaskets unacceptable. Use ring liquid gaskets on raised face flanges and full faced liquid gaskets on raised face flanges and full faced baskets on flat faced flanges. Use 1034 kPa (150 Psi) flanges on water system operating to 689 kPa (100 Psi). Above 689 kPa (100 Psi) use 2068 kPa (300 Psi) flanges.
- .6 Branch connections of sizes 13mm (1/2") 19mm (3/4") and 25mm (1") for radiation may be formed on mains of 50mm (2") diam. and above using carbon steel Thread-O-Let welding fittings, manufactured to ASTM A181, Grade 1.
- .7 Branch connections of sizes 33mm (1 1/4") and larger to be formed using Weld-O-Lets. Reductions in mains to be after branches using butt weld reducing fittings. Weld-O-Lets manufactured to ASTM A181, Grade 1. Site or shop fabricated welding fittings not permitted.
- .8 Welding to suit Provincial Department of Labour Regulations. Welders to be licensed.
- .9 Use long radius elbows. For Pipe reductions use eccentric reducing sockets.
- .10 Provide screwed or flanged connections at all pieces of equipment. Keep pipe connections clear for tube removal, etc.
- .11 Use Grinnell backing rings on butt welded joints in piping other than flanges. Remove nubs.

**3.2 VALVES**

- .1 Provide isolating valves in the following locations and where shown on the drawings.

- .1 Suction and discharge of pumps.
- .2 Before all temperature control valves.
- .3 Each piece of heating equipment.
- .2 Provide three valve by-passes in the following locations and where shown on the drawings:
  - .1 Pressure reducing valves.
  - .2 Temperature control valves on heating coils where the inlet air temperatures are 5<sup>0</sup>C (41<sup>0</sup>F) and below.
- .3 All radiation elements which are not controlled by a thermostat and automatic control valve shall be provided with a balancing valve.
- .4 Provide check valves on parallel operation pump discharges and also where noted. The check valves shall be installed in a horizontal section of piping.
- .5 Provide balancing valves in the following locations and where noted.
  - .1 Pump Discharges.
  - .2 Outlet piping from all water coils and sectional runouts on piping system.
- .6 Valves on all water systems shall be gate type valves except for radiator valves and bypass valves which shall be globe type.
- .7 Valves installed in concealed locations, ie., ceiling spaces, to be arranged for ease of access for servicing through access doors.
- .8 A union or flange dependent on size of piping shall be provided between valves and the equipment which they serve to permit isolation and removal of the equipment.

### 3.3 PIPE SYSTEM

- .1 Water Piping Systems:
  - .1 Grade up in flow direction or as noted so air may pass through connecting risers, etc. Minimum grading to be 1:480.
- .2 General:
  - .1 Install branch riser take-offs to grade up to riser.
  - .2 Run piping parallel to walls and as unobtrusive as possible when viewed from inside or outside building.
  - .3 Where pipe change in direction is shown to take up expansion, spring piping cold.
  - .4 Use screwed fittings on radiator runouts to take up pipe movement.
  - .5 Blow out radiation and coils with compressed air prior to piping connections.
  - .6 Use welded piping in concealed areas and as a result inaccessible, ie., plastered ceilings, etc. Control valves, etc. to be accessible through access doors.
  - .7 Install drain cocks on each pump and at system low points. Pipe to nearest floor drain.
  - .8 Contractor to protect all finned coils against damage during construction period. Comb out fins on completion. Damaged finned elements to be replaced.
  - .9 Locate radiation including force-flow units, unit heaters, wall fin and convectors, etc. in relation to room features.

### 3.4 TESTING OF SYSTEMS

- .1 Tests to be carried out in accordance with following time pressure requirements and regulations and requirements of authorities having jurisdiction.

- .1 Hot water heating at 862 kPa (125 Psi), or to a pressure 1 1/2 times operating pressure, whichever is largest, for 12 hours.
- .2 Piping, concealed prior to completion of total service, to be test in sections prior to concealment. Tests to be witnessed by Contract Administrator's representative. Two working days prior notice to be given Contract Administrator of such tests. Pressures to be as registered at systems highest point. When sections are being tested additional pressure developed by static head of remainder of system above, to be added to specified test pressure.
- .3 Tests to be with water, unless noted otherwise, prior to insulation being applied.
- .4 System test to be with equipment connected. Trap diaphragms to be removed and system flushed prior to test.
- .5 Make good leaks, replace defective parts, flush out defective section, re-test and adjust until system functions correctly.
- .6 Prior to The City Of Winnipeg's takeover, systems to be balanced and ready for operation, with traps strainers, drip legs, etc. cleaned.

**PART 4 - SCHEDULES**

TABLE 11 - PUMPS

| Mark | Mfrs. | Model | Motor | Rpm  | Gpm | Hd | Impeller | Remarks |
|------|-------|-------|-------|------|-----|----|----------|---------|
| PU-1 | Taco  | 2007  | 3 Hp  | 1760 | 81  | 45 | 7.50     | A, B    |
| PU-2 | Taco  | 2007  | 3 Hp  | 1760 | 81  | 45 | 7.50     | A, B    |

**Remarks:**

(A) Motor to be high efficiency type.

(B) Pump supplier shall meet horsepower requirements stated and "not" submit based only on "HD"/"GPM" listed above. Match the maximum flow characteristics of the pump frame size not the listed performance.

TABLE 12 - AIR SEPARATOR

| Mark     | Mfrs. | Model | Strainer | Strainer Face Area | Max. Flow GPM | Remarks |
|----------|-------|-------|----------|--------------------|---------------|---------|
| AIR.S.-1 | Taco  | AC3F  | ✓        | 51 Sq. inches      | 190           |         |

TABLE - 13 - EXPANSION TANK

| Mark     | Mfrs. | Model | Pneumatic | Bladder | Volume  | Dia.          | Remarks |
|----------|-------|-------|-----------|---------|---------|---------------|---------|
| EXP.T. 1 | Taco  | CA300 |           | ✓       | 79 GAL. | 24"X57 1/4 "H |         |

TABLE 14 - CABINET UNIT HEATER: VERTICAL

| Mark | Mfrs.    | Model | Size | BTU     | Motor  | Cfm  | GPM   | WPD | Remarks |
|------|----------|-------|------|---------|--------|------|-------|-----|---------|
| UH-1 | Eng. Air | H-8   |      | 120,700 | 1/4 Hp | 2280 | 14.26 | 1.5 | A       |

**Remarks:**

(A) Thermostat by Controls Sub-Contractor.

TABLE 15 - NATURAL GAS BOILERS

| Mark | Mfrs.            | Model | BTU/Input | BTU/Output | Hp | Remarks |
|------|------------------|-------|-----------|------------|----|---------|
| B-1  | Ray Pak Hi Delta | 652A  | 650,000   | 546,000    |    | A, B, C |
| B-2  | Ray Pak          | 652A  | 650,000   | 546,000    |    | A, B, C |
| B-3  | Ray Pak          | 652A  | 650,000   | 546,000    |    | A, B, C |

**Remarks:**

(A) This Contractor to provide control package, Boiler Management System (Ray Pak) panel, devices and wiring for boiler(s). All work related to the control and or monitoring to be by Contractor. Note certification of installation required.

(B) Make provision for tie in (single point) of remote monitoring points as outlined in designated 15600: Work Description

(C) Sidewall vent is by the boiler supplier.

**TABLE 16 – BALANCING VALVES**

| <b>Mark</b> | <b>System Location</b> | <b>Model</b> | <b>GPM</b> | <b>Size</b> | <b>Turns</b> | <b>Remarks</b> |
|-------------|------------------------|--------------|------------|-------------|--------------|----------------|
| BV-1        | Pump PU-1              | STAD         | 81         | 2 ½         | 2            | A              |
| BV-2        | Pump PU-2              | STAD         | 81         | 2 ½         | 2            | A              |
| BV-3        | Boiler B-1             | STAD         | 52         | 2 ½         | 2            | A              |
| BV-4        | Boiler B-2             | STAD         | 52         | 2 ½         | 2            | A              |
| BV-5        | Boiler B-3             | STAD         | 52         | 2 ½         | 2            | A              |
| BV-6        | Return leg #1          | STAD         |            | 2           | 2            | A              |
| BV-7        | Return leg #2          | STAD         |            | 2           | 2            | A              |
| BV-8        | Return leg #3          | STAD         |            | 1 ½         | 2            | A              |
| BV-9        | Return leg #4          | STAD         |            | 1 ½         | 2            | A              |
| BV-10       | Return leg #5          | STAD         |            | 1 ½         | 2            | A              |
| BV-11       | Unit heater UH-1       | STAD         |            | 1           | 2            | A              |

**Remarks:**

**(A)** Based on Tour and Andersson.

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**PART 1 - GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specification shall apply to and form an integral part of this section.
- .2 All air distribution systems shall meet Manitoba Building Code, ASHRAE and SMACNA Standards.

**1.2 WORK INCLUDED**

- .1 Work shall include but not limited to the following:
  - .1 Remove existing combustion air and exhaust air fan arrangement and provide new combustion air. Install new boiler exhaust. Note to include removal of all existing window sections and providing new wall infill section c/w insulated wall with exterior finish.
  - .2 Remove existing chimney and flue to existing boiler and existing hot water tank.

**1.3 RELATED WORK SPECIFIED ELSEWHERE**

- .1 Mechanical General Provisions: Section 15010
- .2 Insulation: Section 15100
- .3 Plumbing: Section 15430
- .4 Testing & Balancing: Section 15990
- .5 Electrical General Provisions: Section 16000

**1.4 REFERENCE STANDARDS**

- .1 SMACNA: HVAC Duct Construction Standards, Metal and Flexible HVAC Duct Leakage Test Manual.
  - .1 Low velocity duct construction standards.
  - .2 NFPA 90A-Latest Revision: National Fire Protection Association -Installation of Air Conditioning and Ventilating.
  - .3 UL-151: Underwriters' Laboratories Air Duct.
  - .4 ADC 106R2: Air Diffusion Equipment Test Code.
  - .5 AMCA 201-73, AMCA 300-67, AMCA 301-77, AMCA 302-73, AMCA 303-73, AMCA 2408-69.
  - .6 Ashrae: Handbook, Fundamentals and Systems Volumes.
    - .1 Air duct design.
    - .2 Duct construction.

**1.5 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 Manitoba Building Code, local Authority having Jurisdiction.

**1.6 ALTERNATIVES**

- .1 Size round ducts installed in place of rectangular ducts indicated from ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.

**PART 2 - PRODUCTS****2.1 DUCT SEALING**

- .1 Seal all joints on all supply, return and exhaust ductwork with high pressure duct sealant.
  - .1 Foster 30-02 Duro-Dyne S-2
- .2 Cover all joints with high pressure duct tape polyvinyl treated, open weave fibreglass, 50mm (2")
  - .1 Duro-Dyne FT-2

**2.2 LOW PRESSURE DUCTWORK**

- .1 Ductwork: Galvanized Steel
  - .1 Lock forming quality: to ASTM A525M, Z90 zinc coating.
  - .2 Thickness: to SMACNA, ASHRAE
  - .3 Fabrication: to SMACNA, ASHRAE
- .2 Joints: Galvanized Steel
  - .1 SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class A seal.
    - .1 Ductmate Canada Ltd. system for propriety joints; Exanno Nexus.
- .3 Fittings: Galvanized Steel
  - .1 Fabrication: SMACNA
  - .2 Radiused elbows: standard radius.
  - .3 Square elbows: to 400mm (16") with single thickness vanes.
  - .4 Square elbows: over 400mm (16") with double thickness vanes.
  - .5 Provide branch and main duct balancing dampers.
  - .6 Sub branch duct with 45° entry and balancing damper on branch and or Sub branch duct with square connection, volume extractor and branch duct balancing damper.
  - .7 Transitions:
    - .1 Diverging: 20° maximum included angle.
    - .2 Converging: 30° maximum included angle.
  - .8 Offsets: radiused elbows.
  - .9 Obstruction deflectors: maintain full cross sectional area. Maximum included angles as transitions.

**2.3 DUCT OPENINGS**

- .1 Use 1.2 mm (18 ga.) galvanized sleeves where ductwork passes through rated floor assemblies. Sleeves to extend 150 mm (6") above floor. Use watertight mastic between sleeved and floor material. (See Section 15010, OPENINGS IN FIRE SEPARATIONS).
- .2 Seal area between ducts and openings with mineral wool and ULC firestop system. Testing to meet ASTM E814: Fire Test of Through-Penetration Firestops. UL 1479: Through-Penetration Firestop Systems. (See Section 15010, OPENINGS IN FIRE SEPARATIONS).

**2.4 WALL OPENINGS**

- .1 Provide 1.2 mm (18 ga.) galvanized sleeve 50 mm (2") wider than wall thickness. Opening located in fire rated walls to have sleeve c/w louvred fire damper to meet code requirements. (See Section 15010, OPENINGS IN FIRE SEPARATIONS).
- .2 Provide 300 mm (12") duct extension in mechanical room openings, where smoke detectors are noted on Electrical drawings, to support detector and provide proper sensing plenums.



**2.5 HANGERS AND SUPPORTS**

- .1 Fabricate strap hangers to same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger 500mm (20"). Hanger configuration to SMACNA details. Hanger not to interrupt exterior duct insulation (See Section 15100 WORKMANSHIP).
- .2 Support vertical ducts at every floor with angle iron collar sized to provide proper bearing. Provide intermediate vertical support at ¼ and ¾ points in addition to angle iron collar at each floor.
- .3 Support horizontal ducts on maximum 2.4 m (80") centres by non-perforated galvanized steel.
- .4 Riveted strap for ductwork 900 mm (36") (either dimension) or less, and minimum 25 mm x 25 mm x 3 mm (1" x 1" x 1/8") galvanized angle iron passing under ducts 925 mm (37") or over (either dimension) with 9.4 mm (3/8") diam. threaded rods suspending angles from structure.
- .5 Use universal concrete type inserts of black malleable iron, for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms.
- .6 Hangers shall be galvanized steel angles with galvanized steel rods, locking nuts and washers to SMACNA following table:

| Duct Size     |             | Angle Size |          | Rod Size |       | Spacing |     |
|---------------|-------------|------------|----------|----------|-------|---------|-----|
| Mm            | In.         | Mm         | In.      | Mm ∅     | In. ∅ | M       | Ft. |
| up to 750     | up to 30    | 25x25x3    | 1x1x1/8  | 6        | 1/4   | 3       | 10  |
| 775 to 1050   | 31 to 41    | 40x40x3    | 2x2x1/8  | 6        | 1/4   | 3       | 10  |
| 1075 to 1500  | 42 to 59    | 40x40x3    | 2x2x1/8  | 10       | 3/8   | 3       | 10  |
| 1525 to 2100  | 60 to 83    | 50x50x3    | 2x2x1/8  | 10       | 3/8   | 2.5     | 8   |
| 2125 to 2400  | 84 to 94    | 50x50x5    | 2x2x3/16 | 10       | 3/8   | 2.5     | 8   |
| 2425 and over | 95 and over | 50x50x6    | 2x2x1/4  | 10       | 3/8   | 2.5     | 8   |

**2.6 TURNING VANES**

- .1 For duct dimensions 456 mm (18") or less:  
In the plane of turn, Junior Vane Rails shall be supplied having the rails 57 mm (2 1/4") wide and vanes spaced on 50 mm (2") centres.
- .2 For ducts larger than 456 mm (18"):  
Duro Vane Rails shall be supplied having the rails 114 mm (4 1/2") Wide and vanes spaced on 114 mm (4 1/2") centres.
- .3 Double thickness turning vanes shall be Duro-Dyne Vane Rails.
- .4 Factory or shop fabricated single thickness and double thickness with trailing edge to recommendation of SMACNA.

## PART 3 - EXECUTION

### 3.1 STANDARDS

- .1 Maintain all standards of constructing and suspending ductwork as set forth in the 'ASHRAE' and SMACNA standards.
- .2 Duct sizes are inside dimensions. If ducts are acoustically lined, outside duct size to be increased as required.
- .3 Single thickness partitions between ducts is not acceptable.
- .4 All ductwork shall seams and joints sealed with Duro-Dyne S2 duct sealers. Apply duct sealer in strict accordance with manufacturers recommendations, to joints and seams to provide a air-tight, water-tight installation. Prior to application, ductwork to be dry and free of greases, etc.

### 3.2 LOW PRESSURE DUCTWORK

- .1 Duct Sizes shown on plans are a guide for duct runs only. Transition and change duct sizes and provide fittings at no extra cost to contract. Confirm site conditions and confer with Electrical drawings.
- .2 Where duct width exceeds 450 mm (18") in largest dimension, stiffen by cross breaking sheets diagonally. Beaded ducts as per SMACNA catalogue Fig. 1.13 acceptable alternative.
- .3 Duct sizes are inside dimensions. If ducts are acoustically lined, outside duct size to be increased as required.
- .4 Provide ducturns in all elbows of ducts 1200 mm (48") wide and greater in segments of 600 mm (24") maximum.
- .5 Single thickness partitions between ducts not acceptable.
- .6 All ductwork shall have seams and joints sealed. Apply duct sealer in strict accordance with manufacturers recommendations, to joints and seams to provide an air-tight, water tight installation. Prior to application, ductwork to be dry and free of grease, etc. Use 6 mm (1/4") bead of material along joints. Material, when dry, to have 3.2 mm (1/8") depth extending 25 mm (1") one each side of joint or seam.
- .7 Where ductwork conflicts with mechanical and electrical piping and it is not possible to divert ductwork or piping to stay within allowable space limitations, provide duct easements. Easements not required on pipes 100 mm (4") and smaller outside dimension, unless this exceeds 20% of duct area. Irregular or flat shaped piping requires duct easement. Hangers and stays in ductwork to be parallel to air flow. If easement exceeds 20% of duct area, duct to be split into two ducts with original duct area being maintained. Easements to be approved by Contract Administrator before installation.
- .8 If ductwork is not adequately braced and/or supported to provide good installation, additional bracing and/or supports to be provided at no extra cost to The City of Winnipeg.
- .9 Assemble round duct sections using beaded couplings attached with sheet metal screws.

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**PART 1 - GENERAL****1.1 GENERAL**

- .1 All drawings and all sections of the specification shall apply to and form an integral part of this section.
- .2 The Air Balance Agency must be a member of the Associated Air Balance Council. (AABC)
- .3 Contractor to provide services of independent Balance and Testing Agency which specialises in the balancing and testing of heating, ventilation, exhaust air-conditioning systems, flue gas set-up, hydronic heating/cooling systems.

**1.2 WORK INCLUDED**

- .1 Labour, material, plant, tools, equipment and services necessary for and reasonably incidental to completion of initial balancing and operation of, all hydronic systems. Flue gas set-up for each burner with efficiency report for each boiler. Boiler room pressure differential reading relative to the building.
- .2 Include extended service of 90 days, after completion of test and balance work, during which time the Contract Administrator at his discretion may request a re-check or resetting of any pump, inlet, outlet, as listed in test report. The agency shall provide technicians to assist the Contract Administrator in making any tests he may require during this period of time.
  - .1 Provide one winter adjustment of systems c/w report.
- .3 The Air Balance and Testing Agency shall work in co-ordination with Section 15800 to assure the installation of all manual adjusting dampers and pitot tube enclosures are as required to allow proper adjustment of the air systems.

**1.3 RELATED WORK SPECIFIED ELSEWHERE**

- |    |                                 |               |
|----|---------------------------------|---------------|
| .1 | Mechanical General Provisions:  | Section 15010 |
| .2 | Ventilation + Air Conditioning: | Section 15800 |
| .3 | Electrical:                     | Division 16   |

**1.4 REQUIREMENTS AND REGULATORY AGENCIES**

- .1 Shall be a member of the Associated Air Balance Council.
- .2 Testing and balancing personnel shall be experienced and certified in balancing of Mechanical Systems in accordance with AABC procedures.
- .3 Use approved instruments. Include types, serial numbers, and dates of calibration of all instruments used.

**1.5 DESCRIPTION**

- .1 Work shall not be done until the system has been completed and in full working order. Division 15 shall put all heating, ventilating, and air-conditioning systems and equipment into full

operation, as the season would demand, and shall continue operation of same during each working day of testing and balancing.

- .2 Air Balance Agency shall supply 4 hard-bound copies of final corrected air balance report for The City of Winnipeg, c/w certification by Air Balance Agency.
- .3 Final payment will not be issued until the air balance report has been submitted to and approved by the Contract Administrator.
- .4 Provide spot checks of the system if called upon by the Contract Administrator. If quantities, rpm's gpm's etc. do not agree with the submitted report, re-balance the system or systems in question, until satisfactory results are received.
- .5 Boiler operation will be a seasonal deficiency.

### 1.6 TESTING PROCEDURES

- .1 Installation data, manufacturer and model size, arrangement discharge and class, motor type, Watts, voltage, phase, cycles and full load amps. Location and local identification data.
- .2 Adjust heating pumps to operate within 5% of design. Provide fluid flow rate, operating pressure, pump r/min, motor operating amps, motor power, velocities as well as equipment name plate data.
- .3 System Schematic.
  - .1 Complete system schematic with required actual flow rates at each outlet or inlet (water). Show room numbers and floors.
  - .2 Pump flow quantities: for each boiler, coil, pressure drops, air and water, quantities at balancing locations design and recorded balances, velocity measurements.
  - .3 After submission of report, perform random check of 20% of inlets and outlets.
  - .4 Provide one copy of completed report to Contract Administrator. After Contract Administrator has reviewed report, Section 15990 shall provide to Contractor sufficient copies of report to insert one in each operating and maintenance manual.