

**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 SCOPE OF WORK**

- .1 Work to include all labour, Material and equipment required for installing, testing and placing in initial operation the following systems as detailed in Specifications of each section and as shown on Drawings.
  - .1 Section 21 05 10 Acceptable Materials & Equipment
  - .2 Section 21 08 10 Insulation
  - .3 Section 22 40 10 Plumbing
  - .4 Section 22 50 10 Fire Protection
  - .5 Section 23 60 10 Liquid Heat Transfer
  - .6 Section 23 80 10 Air Distribution
  - .7 Section 23 90 10 Testing, Adjusting and Balancing
  - .8 Section 25 10 10 Controls/Instrumentation
- .2 All Mechanical Work to be bid as a single complete sub-Contract even though Work of various mechanical trades has been further sub-divided into each Section noted above.

**1.3 REQUEST FOR INTERPRETATION PROCESS**

- .1 General:
  - .1 Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Contract Administrator in the form specified.
  - .2 Contract Administrator will return RFIs submitted to Contract Administrator by other entities controlled by Contractor with no response. The RFI will then be considered closed.
  - .3 Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's Work or Work of Subcontractors.
  - .4 For RFIs submitted electronically, include project name and RFI number in subject line of email.
- .2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - .1 Project name (including building number).
  - .2 Project number.
  - .3 Date.
  - .4 Name of Contractor.
  - .5 Name of Contract Administrator.
  - .6 RFI number, numbered sequentially. (eg: RFI-001)
  - .7 RFI subject.
  - .8 Specification Section number, title and related paragraphs, as appropriate.
  - .9 Drawing number and detail references, as appropriate.
  - .10 Field dimensions and conditions, as appropriate.
  - .11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Price, Contractor shall state impact in the RFI.

- .12 Contractor's signature.
- .13 Attachments: Include sketches, descriptions, measurements, photos, product data, Shop Drawings, coordination Drawings, and other information necessary to fully describe items needing interpretation.
  - .1 Include dimensions, thicknesses, structural grid references, and details of affected Materials, assemblies, and attachments on attached sketches.
- .3 RFI Forms: Contractor generated form including all content indicated in this Section.
  - .1 Form and attachments shall be electronic files in Adobe Acrobat PDF format.
- .4 Contract Administrator's Action: Contract Administrator will review each RFI, determine action required, and respond. Allow 10 Working days for Contract Administrator's response for each RFI. RFIs received by Contract Administrator after 1:00 p.m. will be considered as received the following Working day.
  - .1 The following Contractor-generated RFIs will be returned without action:
    - .1 Requests for approval of submittals.
    - .2 Requests for approval of substitutions.
    - .3 Requests for approval of Contractor's means and methods.
    - .4 Requests for approval of corrective actions for deficient Work.
    - .5 Requests for coordination information already indicated in the Contract Documents.
    - .6 Requests for adjustments in the Contract Time or the Contract Sum.
    - .7 Requests for interpretation of Contract Administrator's actions on submittals.
    - .8 Incomplete RFIs or inaccurately prepared RFIs.
  - .2 Contract Administrator's action may include a request for additional information, in which case Contract Administrator's time for response will date from time of receipt of additional information.
  - .3 If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Contract Administrator in writing within 10 days of receipt of the RFI response. Failure to notify will result in the Work being included as part of the Contract.
- .5 RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log with progress meeting minutes. Include the following:
  - .1 Project name.
  - .2 Name and address of Contractor.
  - .3 Name and address of Contract Administrator.
  - .4 RFI number including RFIs that were returned without action or withdrawn.
  - .5 RFI description.
  - .6 Date the RFI was submitted.
  - .7 Date Contract Administrator's response was received.
- .6 On receipt of Contract Administrator action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Contract Administrator within 10 days if Contractor disagrees with response.

#### **1.4 EXISTING CONDITIONS**

- .1 Examine Site, existing adjacent buildings and local conditions affecting Work under this Contract. Examine Structural, Mechanical and Electrical and all other Contract Drawings to ensure Work can be performed without changes to the building as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences have been brought to Contract Administrator's attention, in writing, prior to closing of Bid Opportunity in accordance with B4.

#### **1.5 REGULATIONS**

- .1 Comply with, most stringent requirements of Manitoba Building Code, National Building Code and local regulations and by-laws, with specified standards and codes and this Specification. Before any Work is proceeded with, approved layouts to be filed with and approved by proper authorities.
- .2 Provide necessary notices, obtain permits and pay all fees, in order that Work specified may be carried out. Charges and alterations required by authorized inspector of any authority having jurisdiction, to be carried out without charge or expense to The City. Pay all charges for service connections to municipal mains.
- .3 Furnish certificates confirming Work installed conforms to requirements of authorities having jurisdiction.

#### **1.6 LIABILITY**

- .1 Install Work in advance of concrete pouring or similar Work. Provide and set pipe 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 The City.
- .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 The City.
- .4 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets. Mount portable fire extinguishers in welding or soldering areas.
- .5 Co-ordinate Work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all Contract Drawings.
- .6 On completion of Work, remove tools, surplus and waste Material and leave Work in clean, perfect condition.

#### **1.7 GUARANTEE**

- .1 Guarantee satisfactory operation of all Work and apparatus installed under this Contract. Replace, at no expense to The City, all items which fail or prove defective within a period of one year after final acceptance of complete Contract by The City, always provided such failure is not due to improper usage by The City. Make good all damage to building incurred as a result of failure or repair of mechanical Work.

- .2 No certification given, payment made, partial or entire use of equipment by The City, shall be construed as acceptance of defective Work or acceptance of improper Materials. Make good at once, without cost to the The City all such defective Work or Materials and consequence resulting therefrom, within one year of final acceptance date.
- .3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

## **1.8 WELDING REGULATIONS**

- .1 Do not weld when temp. of base metal is lower than -17 deg. C except with consent of Contract Administrator. At temp. below 0 deg. C, surface of all areas within 75mm (3") of point where weld is to be started to be heated to temp. at least warm to hand before welding is commenced. At all temperatures below +4 deg. C, operator and Work to be protected against direct effect of wind and snow.
- .2 Welding shall be performed by welder holding current welder's certificate from Provincial Department of Labour.
- .3 Comply with CSA W117.2 "Safety in Welding, Cutting, and Allied Processes".

## **1.9 MECHANICAL SHOP DRAWINGS**

- .1 Submit for review PDF (Electronic Copy) of detailed Shop Drawings. Refer to Section 21 05 10 "Acceptable Materials & Equipment" for Shop Drawings requirements.
- .2 Check Shop Drawings for conformity to plans and Specifications before submission.
- .3 Each Drawing to bear a signed stamp including project name and Contractor's Firm name verifying Drawings have been checked prior to submission to Contract Administrator. Signature of stamp shall signify the Contractor has checked and found all dimensions to be compatible with the Contract Drawings and all capacities, quantities, sizes and other data contained in the Contract documents have been listed by the supplier on the Drawings and have been checked by the undersigned and found correct.
- .4 Clearly show division of responsibility. No item, equipment or description of Work shall be indicated to be supplied or Work to be done "By Other's or By Purchaser". Any item, equipment or description of Work shown on Shop Drawings shall form part of Contract, unless specifically noted to contrary.
- .5 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 Subcontractors are aware of these dimensions and shall comply to them.
- .6 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 of 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 documents.

**1.10 MECHANICAL SUBCONTRACTORS**

- .1 State in Bid Opportunity, names of all Subcontractors to be used in sublet Work. Also, state extent of any Work so sublet. Request and receive Contract Administrator's approval in writing, of all Subcontractors for such Work before placing Subcontractor Contract.
- .2 Contractor to have minimum five years experience in field of mechanical Contracting and to have successfully performed Work of similar nature and approximate size to that indicated in Specifications and on Drawings. Subcontractors shall employ, on this project, foremen or supervisory personnel who have had similar experience to that required of Contractor.

**1.11 SCHEDULING OF WORK**

- .1 Complete building to be occupied during term of this Contract. Schedule new Work so normal functions within building are not unduly interrupted. Suitable periods for shutting off mechanical services to be arranged with The City's appointed representative.
- .2 Refer to clause D2, Scope of Work, in Supplemental Conditions which is part of the front end Specifications.

**1.12 DRAWINGS**

- .1 Drawings are diagrammatic only and do not show all details. Information involving accurate measurements of building to be taken at Site. Make, without additional expense to The City, all necessary changes or additions to runs to accommodate structural conditions. Locations of pipes, ducts and other equipment to be altered without charge to The City, provided change is made before installation and does not necessitate additional Materials and that all such changes are ratified by Contract Administrator, recorded on Record Set of Drawings.
- .2 Drawings and Specifications to be considered as an integral part of Contract Documents. Neither Drawings nor Specifications to be used alone. Misinterpretation of requirements of plans or Specifications shall not relieve Contractor of responsibility of properly completing Work to approval of Contract Administrator.
- .3 As Work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for comments. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.
- .4 Drawings indicate general location and route to be followed by pipes and ducts. Where required pipes and/or ducts are not shown on plans or only shown diagrammatically, install in such a way as to conserve head room and interfere as little as possible with free use or space through which they pass.
- .5 Spaces reserved for equipment noted as "future", to be left clear as noted on Drawings so that future connections can be made.

**1.13 MATERIALS**

- .1 Materials and equipment specified and acceptable manufacturers are named in this Specification for the purpose of establishing the standard of Materials and Workmanship to which Contractor shall adhere. Bid Opportunity price shall be based on the use of Materials and equipment as specified.

- .1 Materials of same general type to be of same manufacture (e.g. all air supply units shall be of same manufacturer). Contractor to ensure that all Subcontractors provide products of same manufacturer.
  - .1 Follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs of individual equipment installed.
  - .2 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems and without interference with building structure or other equipment.
  - .3 Provide accessible lubricating means for bearings, including permanent lubricated 'Lifetime' bearings.
- .2 Contractor may propose alternate for any specified item which Contractor considers equal in accordance with B7 to that specified. Submit with Bid Opportunity complete Specifications for proposed alternate together with amount to be added to or deducted from Bid Opportunity price for consideration by Contract Administrator. All alternate items submitted for consideration must not exceed available space limitations. All additional costs for mechanical, electrical, structural and/or architectural revisions required to incorporate Materials substituted by Contractor shall be responsibility of Contractor.
- .3 Equipment listed as 'equal in accordance with B7' in Specifications or submitted as alternate by Contractor must meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with manufacturer's published recommendations.
- .4 Equipment and Materials shown on Drawings and not specified herein, or specified herein and not shown on Drawings, shall be included in this Contract as though both shown and specified.

**1.14 REMOVAL AND DISCONNECTION OF THE CITY'S EXISTING EQUIPMENT**

- .1 All mechanical equipment conflicting with new equipment being installed to be removed or disconnected by Contractor shall remain property of The City. Remove ducts and piping not required in revised systems and interfering with new installation which shall become property of Contractor.
- .2 Mechanical Drawings indicate most mechanical equipment to be removed and/or disconnected. Mechanical equipment to be removed due to removal of walls of existing building, to be removed and pipes capped off by Contractor at no additional cost to The City.

**1.15 ELECTRIC MOTORS, STARTERS AND WIRING**

- .1 Provide electric motors for all equipment supplied in this Division. Motors to operate at 29 rps (1800 rpm), unless noted otherwise. Motor design shall comply with Canadian Electrical Code requirements. 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 Operating voltages: to CAN3-C235-83, motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .4 Motors controlled by variable frequency drives (VFDs) shall comply with requirements of CSA Specification C22.2 No. 100-95, Clause 12.4 and shall be permanently marked with the following in addition to the normal marking requirements:
  - .1 Machine Application (Inverter Duty);
  - .2 Speed range over which the machine is designed to operate;
  - .3 Type of torque application for which the machine is designed (e.g. VT (variable torque), CT (constant torque), Chp (constant horsepower);
  - .4 Type(s) of inverter(s) with which the machine is intended to be used [e.g.: VSI or VVI (6-step voltage source), CSI (6-step current source), VPWM (voltage-source pulse width modulated), LCI (load commutated), cyclonverter].
- .5 Electric motors for use in hazardous locations shall have a metal nameplate marked with the following information:
  - .1 For a motor for use with variable-frequency inverter drives: The type or types of inverters, motor load characteristics, and the frequency range; for example, "PWM-Constant Torque-6 to 60 Hertz". All motor base performance values are to correspond to rated sine-wave operation. Additional markings for inverter operation may be included.
- .6 Motors 0.75 kW (1 hp) and larger shall be high efficiency motors as defined in CSA C390 or IEEE 112B Nominal Standards. Minimum efficiency (%) shall be per the following table.

kW	Minimum efficiency (%)			
	3600 RPM	1800 RPM	1200 RPM	900 RPM
.75	79.0	82.4	81.1	74.4
1.11	81.0	82.8	83.8	76.8
1.50	81.7	83.8	84.4	83.8
2.24	84.6	86.1	86.4	83.6
3.73	86.4	86.9	87.2	85.4
5.60	87.4	88.4	88.2	86.2
7.46	88.4	89.4	88.6	88.6
11.19	89.3	90.1	89.0	88.0
14.92	89.7	90.9	89.8	89.8
18.65	90.0	91.1	90.9	89.6
22.38	90.6	91.5	91.1	90.3
29.84	91.0	92.0	91.6	90.1

List information on Shop Drawing submittals

- .7 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 ordering motors.
- .8 Division 26 - Electrical to provide starters for all motors, except as otherwise noted. Division 26 - Electrical shall wire from starters to motors.

- .9 Wiring required between starters and switching apparatus such as wiring from starters to float switches, pressure switches and all control wiring to be by Division 26 - Electrical except as noted otherwise on Drawings and in Specifications. Provide proper terminal connections and lead wires at motors and other apparatus ready for connection by Division 26 - Electrical. Provide Division 26 - Electrical with accurate locations of electrical connection points and all necessary schematic and other Drawings to facilitate electric Work.
- .10 Wiring required under Section 25 10 10 to be performed by Section 25 10 10 except as noted otherwise. Refer also to Section 25 10 10 for further requirements.
  - .1 Division 26 - Electrical to perform all wiring and make final connections to all controls for roof-top HVAC units, boilers and all mechanical equipment where controls are supplied with equipment.
  - .2 Division 23 shall provide wiring diagrams indicating all power and control wiring requirements.

#### **1.16 IDENTIFICATION OF VALVES**

- .1 Provide engraved lamacoid color coded tags secured to items with non-ferrous chains or "S" hooks. Use for valves and operating controllers of all systems. Consecutively number valves in each piping system i.e. domestic water, steam, etc.
- .2 For each building, provide tag schedule, designating number, service, function, colour code, and location of each tagged item.
- .3 Provide one plastic laminated copy and secure to mechanical room wall where instructed. Place one copy in each maintenance instruction manual.
- .4 Identify controls and gauges by labels of 3mm (1/8") plastic engraving stock with white lettering on black background. Size approximately 62mm x 25mm (2-1/2" x 1") high.

#### **1.17 HANGERS AND SUPPORTS**

- .1 General
  - .1 Piping, ductWork and equipment shall be securely supported from building structure. Perforated strap or wire hangers are not permitted.
  - .2 Support components shall conform to Manufacturers Standardization Society Specification SP-38.
- .2 Installation - Horizontal
  - .1 Hangers shall adequately support piping system. Locate hangers 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. Piping weight and stresses shall be supported independently of any equipment.
  - .2 Maximum spacing between pipe supports:
    - .1 Steel Pipe:
      - .1 Up to 50mm (2") diam. - 2.4m (8 ft.)
      - .2 62mm (2-1/2") and larger - 3.6m (12 ft.)
    - .2 Copper Tubing (Hard):
      - .1 Up to 25mm (1") diam. - 1.8m (6 ft.)
      - .2 32mm and larger - 2.4m (8 ft.)
    - .3 Cast Iron Pipe
      - .1 Maximum spacing - in accordance with Plumbing Code. Locate hangers adjacent to hubs or joints.



- .7 For vertical piping support, use Anvil Fig. 261 clamp. For vertical copper piping, use Fig. CT-121-C.
- .8 Above indicates general requirements. Provide hangers and supports of equal in accordance with B7 quality to suit job requirements where not covered by the above.
- .9 Support groups of horizontal pipes by angle iron trapeze hangers.
- .10 Rollers and chairs shall not be installed on trapeze hangers.
- .11 Several individual hanger rods may be supported from a trapeze or individual inserts in concrete slab.
- .12 Hangers to be adjustable after pipe is in place. Parts must be of adequate strength for weight to be supported with safety factor of 5 to 1.
- .13 Hanger Rod:
  - .1 Support hangers with mild steel rod. Load on hanger not to exceed capacity indicated in following table:
  - .2 Rod Diam. Max. Safe Load
    - .1 9.5mm(3/8") 277 Kg(610 lbs.)
    - .2 13mm(1/2") 514 Kg(1130 lbs.)
    - .3 16mm(5/8") 822 Kg(1818 lbs.)
    - .4 19mm(3/4") 1232 Kg(2710 lbs.)
  - .3 Rods to have sufficient threaded length to allow for vertical adjustment after pipe is in place. Use two nuts in each rod, one above clevis or angle iron, and one below.
- .6 Isolation
  - .1 Copper piping shall be isolated from steel supports by copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators. Where no pipe movement or abrasion is expected, suitable plastic electricians tape may be wrapped around pipe at hangers.
- .7 Protection Saddles
  - .1 On piping 50mm (2") and smaller, carry insulation over pipe hangers. Canvas jacket shall be neatly cut and formed to fit over hangers. On chilled and cold water piping, insert sections of insulation into space above pipe at each hanger. Seal saddle and pipe with insulation.
  - .2 On insulated steel pipe over 50mm (2") diam. use at each hanger or support, Anvil Fig. 160, 161 or 162 to suit pipe size and insulation thickness. Pack space between saddle and pipe with insulation.
  - .3 On copper piping over 50mm (2") diam. use at each hanger or support Anvil Fig. 167 protection shield. Shields shall have minimum length of 300mm (12") to spread weight.

## **1.18 SUPPORTS, 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 to be supplied under structural division. 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 150mm (6") concrete pad. Refer to standard details for method of forming pump bases, etc.

- .3 Mount equipment suspended above floor level but not detailed on platform bracketted from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.

#### **1.19 FLASHING**

- .1 Where pipes or ducts go through a roof or wall, they should be boxed-in and flashed as per structural division. Allow for expansion and Contraction of pipe. Flashing shall be waterproof.

#### **1.20 IDENTIFICATION OF EQUIPMENT**

- .1 Provide manufacturer's nameplate on each piece of equipment.
- .2 In addition Mechanical Subcontractor shall provide equipment I.D. tag minimum size 87mm x 32mm x 2.3mm (3-1/2" x 1-1/2" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6mm (1/4") high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.
- .3 Identify as follows: equipment type and number (e.g. pump no. 2), service or areas or zone building served (e.g. south zone chilled water primary).
- .4 Provide manufacturers' registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.

#### **1.21 FLOOR PLATES AND SLEEVES**

- .1 Set sleeves in concrete forms for all pipes and ducts passing through concrete walls, beams and slabs.
- .2 Pipe sleeves to extend above floor line as follows:
  - .1 Unfinished areas - 25mm (1")
  - .2 Mechanical rooms - 100mm (4")
  - .3 Caulk sleeves to provide watertight installation.
- .3 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated pressed floor plates.
- .4 Install galv. oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.
- .5 Sleeves and holes for cold water and chilled water to be large enough to accommodate pipe insulation. Insulation on hot water lines may stop at walls or floors.
- .6 Prior to installing sleeves in concrete beams, receive final jobSite approval by the Contract Administrator.

#### **1.22 MECHANICAL EQUIPMENT GUARDS**

- .1 Meet safety requirements of Provincial Department of Labour and local authorities having jurisdiction.
- .2 Guards for drives shall have:
  - .1 No. 2.5mm (12 US std. ga.) galv. 18mm (3/4") mesh wire screen welded to steel angle frame.
  - .2 No. 1.2mm (18 US std. ga.) galv. sheet metal tops and bottoms.

- .3 Removable sides for servicing.
- .3 For flexible couplings, provide removable, 'U' shaped, 2.5mm (12 ga.) galv. frame and 1.2mm (18 ga.) expanded mesh face.
- .4 Provide means to permit lubrication and use of test instruments with guards in place.
- .5 Install belt guards to permit movement of motors for adjusting belt tension.
- .6 Provide 18mm (3/4") mesh wire screen on inlet or outlet of exposed fan blades.
- .7 Provide 37mm (1-1/2") diameter hole on shaft centre for insertion of tachometer.

### **1.23 V-BELT DRIVES**

- .1 Fit reinforced belts in sheave grooves matched to drive.
- .2 For 0.25 KW (1/3 hp) to 7.46 KW (10 hp) motors use standard adjustable pitch drive sheaves, having plus/minus 10% range. Use mid-position of range for specified rpm.
- .3 For over 7.46 KW (10 hp) motors, use sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Refer to Section 15600 and 15800 for fan requirements relating to V-belt, vari-pitch drives. Provide sheave of correct size as approved by Contract Administrator to suit balancing.
- .4 Use minimum drive rating of two times nameplate rating on motor. Keep overhung loads under manufacturer's requirements on all prime mover shafts.
- .5 With belt drive, provide motor slide rail adjustment plates, allowing for 150mm (6") minimum centre line adjustment.
- .6 Obtain approval to use cast iron or steel sheaves secured to shafts with removable keys.

### **1.24 SCREWS, BOLTS AND FASTENERS**

- .1 Use standard commercial sizes and patterns with Material and finish suitable for service.
- .2 Use heavy hex heads, semi-finished unless otherwise specified. Use non-ferrous Material throughout for plumbing services. Use type 304 stainless steel for exterior areas.
- .3 Bolts used on fan equipment for access to motors, bearings, filters and the like shall be heavy-duty.
- .4 Bolts shall not project more than one diameter beyond nuts.
- .5 Washers
  - .1 Use plain-type washers on equipment, sheet metal and soft gaskets, lock-type washers where vibration occurs, and resilient washers with stainless steel.

### **1.25 SPECIAL TOOLS AND SPARE PARTS**

- .1 Furnish the The City with spare parts as follows:
  - .1 One set of pump seals, packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass installed.
  - .4 One set of v-belts for each piece of machinery.
  - .5 One set of filters for each filter bank installed. ie. one set for both pre-filter and high efficiency filters.
  - .6 One 55 gallon drum of glycol
  - .7 One condensate neutralizer

- .2 Identify spare parts containers as to contents and replacement parts number.
- .3 Provide one set of all specialized tools required to service equipment as recommended by manufacturers.
- .4 Furnish one grease gun and adaptors to suit different types of grease and grease fittings.

**1.26 PUMPS-GENERAL**

- .1 Provide coupling guards on all pumps.
- .2 Submit certified pump curves with Shop Drawings. Pumps shall be selected such that head at design conditions does not exceed 85% of maximum possible head at design flow rate.
- .3 Manufacturer to include for checking and aligning pumps prior to start-up. Following completion of piping all base mounted pumps shall be aligned by a qualified millwright using a dial gauge. Alignment using a straightedge is not acceptable as it does not provide sufficient accuracy. The millwright shall provide a report indicating the degree of misalignment prior to carrying out the Work and the final readings when the alignment Work has been completed. Final payment will not be made until a satisfactory report has been submitted.
- .4 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.
- .5 All pumps to have motor size large enough to not overload at runout condition. If this requires larger motor than specified, pay for larger motor starter, wiring and the like.
- .6 Provide mechanical seals on all pumps.

**1.27 OPENINGS IN FIRE SEPARATIONS**

- .1 Provide firestopping for all openings in fire separations for passage of pipes, ducts, etc. to maintain integrity of fire separations.
- .2 Firestopping
  - .1 Firestopping to be Dow-Corning Fire Stop System.
  - .2 Material shall be Dow-Corning silicone elastomer Fire Stop penetration Seal and/or Dow-Corning liquid silicone elastomer Fire Stop Foam of density, width and depth to maintain assembly fire resistive rating.
  - .3 Components shall be ULC listed.
- .3 Installation
  - .1 Prepare all surfaces so they are clean, dry, and frost free, as per manufacturer's published recommendations.
  - .2 Use Sealant around single pipes and/or ducts.
  - .3 Use Foam for multiple pipe installation.
  - .4 Follow manufacturer's published installation instructions precisely including field quality control after installation.
  - .5 Submit to Contract Administrator, suitable document signed by manufacturer's local representative, stating:
    - .1 Div. 21 Subcontractor received sufficient installation instruction from manufacturer's representative.
    - .2 Manufacturer's representative witnessed installation procedures on Site.
  - .6 Remove firestopping assembly for random inspection by Contract Administrator and replace at no extra cost to The City.

- .7 Issue report to Contractor, The City and Contract Administrator stating that all mechanical openings have been fire stopped in accordance with fire stop mfg. methods to maintain integrity of fire separation being penetrated.

**1.28 TRIAL USAGE**

- .1 The City 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 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, whether caused by weakness or inaccuracy of parts, or by defective Materials or Workmanship of any kind whatsoever. Supply all labour and equipment for such tests.

**1.29 SAFETY DEVICE TESTING**

- .1 Make complete inspection of all safety devices to ensure:
  - .1 That safety devices are complete and in accordance with Specifications and manufacturer's recommendations.
  - .2 That the safety devices are connected and operating according to all local regulations.
- .2 Safety devices to be inspected shall include, but not be limited to:
  - .1 Pressure relief valves
  - .2 Low-water cut-offs
  - .3 High or low water alarms
  - .4 Sprinkler alarm valves
  - .5 Carbon monoxide detectors
  - .6 Freeze protection devices
  - .7 Fire dampers
- .3 On completion of inspections, supply to Contract Administrator letters and/or certificates for their record, confirming that inspections have been completed.

**1.30 TEMPORARY USE OF EQUIPMENT**

- .1 Permanent systems and/or equipment not to be used during construction period, without Contract Administrator's written permission.
- .2 Heating systems may be used for temporary heating within limitations specified under clause 'Temporary Heating'.
- .3 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 and The City.
- .4 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.
- .5 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment so used this guarantee period to commence as of date of final acceptance of building by The City as interpreted by Contract Administrator.

- .6 All air filters shall have bi-monthly inspection. Filters shall be cleaned and/or replaced depending on filter type during period in which ventilation units are being used for temporary heat and/or commissioning of system. Contractor to be responsible for and pay all costs for air filter cleaning service. Filters to operate between pressure drops noted in filter manufacturer's catalogue.

### **1.31 RECORD DRAWINGS**

- .1 As Work progresses, record on one (1) set of Contract Drawings, any approved changes and deviations from the original Contract and/or Working Drawings. Have these Drawings available for reference and observation at all times. At completion of Work, submit to the Contract Administrator, at the Contractor's Costs, AutoCAD Record Drawings and one hardcopy set of Record Drawings. The Contract shall not be considered complete and no final payment shall be made until these Drawings are accepted by the Contract Administrator. Provide separate Drawings for each system in order not to "crowd" Drawings.

### **1.32 INSTRUCTIONS TO THE CITY'S PERSONNEL**

- .1 In addition to start-up supervision and instruction of The City's personnel required of individual equipment manufacturers and systems as noted, Contractor's construction supervisor to instruct The City's personnel in operation and maintenance of all equipment and systems to satisfaction of Contract Administrator.
  - .1 All instructions to The City's personnel shall be video taped by the Contractor.
  - .2 This video will remain property of the The City and will be used for the sole purpose of training and orientation of The City's maintenance staff.
  - .3 Instruction shall include visual Materials such as Drawings, diagrams, and printed handouts.
  - .4 Instructor(s) shall provide the necessary audio-visual equipment and other aids necessary to convey thorough understanding of system and/or equipment operation and maintenance.
  - .5 Provide The City with one copy of video taped session in DVD format.
- .2 Provide The City with four copies of manuals incorporating following:
  - .1 Service instructions - including lists of spare and replacement parts and names and addresses of suppliers.
  - .2 Maintenance & Operating instructions.
  - .3 Revised Shop Drawings.
- .3 Forward manuals to Contract Administrator for review. Final payment will not be made until all required manuals have been received.
- .4 Review instructions with The City's representative to ensure The City's representative has a thorough understanding of equipment and its operation.
- .5 Contractor shall submit to Contract Administrator, suitable document signed by The City's representative, stating:
  - .1 The City has received satisfactory instruction in operation and maintenance of all equipment and systems.
  - .2 Operation and maintenance manuals have been reviewed with The City.
  - .3 Specified spare parts, keys, removable handles and the like, have been turned over to The City.

**1.33 PAINTING**

- .1 Finish painting of mechanical equipment, piping, ductwork and the like shall be performed by a competent painting Subcontractor of Division 21 - Mechanical.
- .2 Following areas shall have equipment and Materials painted:
  - .1 Boiler Room.
  - .2 Mechanical Room.
  - .3 All roof top and outdoor exposed areas.
- .3 Thoroughly clean off rust and oil, all exposed iron and steel Work of every description, including hangers, pipes, ducts, etc. paint with a coat of chrome oxide phenolic base primer and a coat of 100% Alkyd base enamel of approved colour. Paint exposed galv. metal surfaces in above areas with a coat of zinc dust galvanize primer and a coat of 100% Alkyd base enamel of approved colour.
- .4 Paint exposed covering in above room and areas with two coats of 100% Alkyd base enamel of approved colour.
- .5 All roof top and outdoor exposed mechanical equipment, ductWork, piping, etc. shall have base prime coat and two finish coats of top-quality, exterior rubber-based paint.
- .6 After piping, etc. has been painted, paint neatly stencilled letters, about 25mm (1") high, designating pipe service and arrows showing direction of flow. Wording to be as later directed by Contract Administrator. Stencilling to occur at not more than fifty foot intervals. "Mystik" tape arrows and identification letters may be substituted, at discretion of Contract Administrator. Stencil all pipes at access doors also.
- .7 All colours shall be approved by Contract Administrator.

**1.34 IDENTIFICATION OF PIPING**

- .1 Refer to section 21 07 10, MECHANICAL PAINTING AND IDENTIFICATION SCHEDULE.

**1.35 IDENTIFICATION OF DUCTWORK**

- .1 Use black 50mm (2") high stencilled letters (e.g. "Cold", "Hot", "Return", "Sanitary Exhaust", "Kitchen Exhaust") with arrow indicating air flow direction.
- .2 Distance between markings 15m (50') maximum.
- .3 Identify ducts on each side of dividing walls or partitions and beside each access door.
- .4 Stencil only over final finish.
- .5 Prior to installation, review general application of identification with Contract Administrator.

**1.36 CUTTING AND PATCHING**

- .1 Cutting, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping in existing building(s) to be included by Div. 21 - Mechanical in Bid Opportunity price. Division 21 - Mechanical to employ and pay appropriate Subcontractor whose Work is involved, for carrying out Work described above.

**1.37 SALVAGE**

- .1 All usable salvaged equipment and Materials shall remain the property of the The City unless specifically noted otherwise. Such Material shall be neatly stored on Site for removal by the The City. Contractor shall remove all rejected salvage from the Site and legally dispose of it.
- .2 Mechanical Drawings indicate most mechanical equipment to be removed and/or disconnected. Mechanical equipment not indicated on Drawings as being removed or disconnected, but which has to be removed due to removal of walls of existing building, to be removed and pipes capped off by Contractor at no additional cost to The City.

**1.38 CLEANING AND FLUSHING OF PIPING SYSTEMS**

- .1 On completion, each piping system shall be flushed out before installation of equipment, fixtures, etc. in order to remove any foreign Material in piping.
- .2 Flush with water, unless noted otherwise in individual mechanical sections of Specifications.
- .3 All plumbing fixtures and all equipment shall be thoroughly cleaned and left in first class operating condition.

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL**

- .1 The 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 Contractor to submit within forty-eight hours of notification from Contract Administrator, one (1) copy of fully and properly completed Appendix of Manufacturers listing thereon names of manufacturers of products which shall be used to execute Work of Contract. If list is not submitted within 48 hours, Contractor must use product named in each individual clause.
- .4 Submit Shop Drawings for all items marked with asterisk(\*).
- .5 Request for equal shall be in accordance with B7.

**1.2 EQUIPMENT OR MATERIAL & APPROVED MANUFACTURERS**

- .1 ELECTRIC MOTORS
  - .1 G.E.; Siemens; Tamper; Reliance; Leland; Lincoln; U.S. Electric; Century; Baldor; WEG; Toshiba
- .2 INSULATION
  - .1 Pipe Insulation Manville; Owens Corning; Knauf; Pabco; Fibreglas
  - .2 External Duct Insulation Manville; Fibreglas; Knauf
- .3 VIBRATION CONTROL
  - .1 Vibration Control Products\* Vibro-Acoustics; Airmaster; Vibron; Kinetics; SVC Ind.
- .4 PLUMBING
  - .1 Gas Valves\* Newman-Milliken
  - .2 Hangers and Supports Anvil; Crane; Myatt; Erico; Caddy
  - .3 Alignment Guides Adsc0; Flexon; Fulton; Yarway
  - .4 Drainage specialties\* Watts; Zurn; Wade; J.R. Smith; Mifab  
(floor drains, cleanouts,etc.)
  - .5 Strainers\* Spirax-Sarco; Muessco; Toyo; Crane; Colton; Watts
  - .6 Gas cocks\* Toyo; Neuman-Milliken; Anvil
  - .7 Gas regulators\* Fisher; Equimeter; Norgas (Itron)
- .5 FIRE PROTECTION
  - .1 Automatic sprinkler equipment\* Reliable; Viking; Victaulic; Tyco Fire Products (Gem, Star, Central)

.6	LIQUID HEAT TRANSFER	
.1	Welding fittings	Anvil; Crane; Tube Turn
.2	Malleable iron fittings, flange, flange gaskets	Crane; Gourd; Anvil; International Malleable
.1	Mechanical joints*	Victaulic; Gruvlok
.3	Pipe hangers	Anvil; Crane; Myatt
.4	Gate, globe valves*	Crane; Toyo; Kitz; Nibco
.5	Check valves (up to 2" diam.)	
.1	Horizontal piping*	Crane; Toyo; Kitz; Nibco
.2	Vertical piping*	Durabla; Nibco
.6	Check valves (2-1/2" diam. & up)	
.1	Horizontal piping*	Moyes & Groves; Chek-Rite; Keystone-Prince; Victaulic; Gruvlok
.2	Vertical piping*	Val-Matic; Durabla; Victaulic; Gruvlok
.7	Butterfly valves*	Keystone; Center Line; Nibco; Victaulic; Jenkins; Gruvlok
.8	Ball Valves*	Toyo; Kitz; Nibco; Victaulic; Newman Hattersley; Jenkins; Anvil
.9	Balancing valves (up to 2")*	Toyo; Kitz; Anvil; Newman Hattersley
.10	Balancing valves (2½" dia & up)*	Keystone; Center Line; Nibco; Victaulic; Jenkins; Gruvlok
.11	Circuit balancing valves*	Armstrong; Tour & Andersson; Gruvlok
.12	Triple duty valves*	Armstrong; B&G; Gruvlok; Victaulic
.13	Suction guides*	Armstrong; B&G
.14	Expansion joints*	Fulton; Flexonics; Hyspan
.15	Alignment guides*	Adsco; Flexon; Fulton; Flexonics; Hyspan
.16	Air vents*	Dole; Hoffman; Maid-O-Mist
.17	Air purgers*	Hamlet & Garneau
.18	Strainers*	Spirax-Sarco; Mueller; Victaulic; Gruvlok; Colton
.19	Thermometers*	Ashcroft; H.O. Terrice; Winters; Taylor; Weiss; Marshalltown
.20	Pressure gauges*	Kunkle; Winters; Ametek; Ashcroft; Terrice; Weiss; Marshalltown
.21	Expansion tanks*	Amtrol; Expanflex; Wessels; B & G; Taco; John Wood; Flexcon
.22	Tank gauges*	Morrison
.23	Relief valves (water)*	Conbraco; Spence; Farris
.24	Condensing Boilers*	Aerco; Viessmann; Buderus
.25	Buffer Tank*	Aerco;
.26	Vertical in-line pumps*	Armstrong; B & G; Taco
.27	Flexible pipe connectors*	Flexonics; Hydro-Flex; United Flexible
.28	Chemical treatment*	GE Betz
.29	Gas-fired make-up unit*	ICE; Engineered Air; Price Mechanical (PMI)
.30	Glycol fill tank*	GE Betz; Hamlet & Garneau
.31	Glycol	Union Carbide; Dow
.32	Vibration control*	Vibron; Vibro-Acoustic; Airmaster
.7	AIR DISTRIBUTION	
.1	Ducturns, damper hardware, fan connections*	Duro-Dyne
.2	Duct Sealer	Duro-Dyne; 3M; Flexa-Duct; United; Bakelite

.3	Filters*	A.A.F.; Camfill-Farr; Cambridge; Continental; Airguard
.4	Centrifugal air foil fans*	CML Northern Blower; Twin City; Greenheck
.5	Diffusers, registers & grilles*	E.H. Price; Hart & Cooley; Titus; Carnes; Nailor
.6	Acoustic duct insulation*	Manville; Fibreglas; Ultralite; Knauf
.7	Vibration control*	Airmaster; Vibro-Acoustics; Vibron; Kinetics
.8	Condensing Boiler chimney*	Heat Fab; Z-Flex
.9	Flexible ductwork*	Thermoflex
.10	Heat recovery units*	Tempeff; BKM
.8	CONTROLS/INSTRUMENTATION	
.1	Temperature control system*	Johnson Controls (Metasys)
.2	Gas detection sensor*	Honeywell Analytics (Vulcain)
.9	H.V.A.C. BALANCE AND TESTING	
.1	H.V.A.C. Balance & Testing Agency	Airdronics Inc.; DFC; AHS; Air Movement

**END OF SECTION**

**Part 1 ALL SERVICES**

- .1 Paint all mechanical lines, conduit and equipment with colour code and identification markings outlined below. Use General Paint colour system specified as guide. All colours shall be accurately matched throughout. Apply minimum of two finish coats (2 mil dry thickness each coat) of premium quality General Paints Enviroguard. All surfaces shall be properly prepared and primed to ensure premium quality paint finish. On hot surfaces, use heat resistant paint rated for long term colour and adhesion at expected operating temperatures. Refer to Colour Schedules at end of this Section.
- .2 Environmental Requirements - do not apply paint finish in areas where dust is being generated. All areas shall be clean and floor swept before commencing. Do not commence Work until ambient temp. is minimum 15°C for previous 12 hours. Protect adjacent Work, finishes, equipment, etc. from paint splatter. Take necessary and reasonable precaution to protect painted surfaces from damage.
- .3 Materials - Paint Materials: Must be volatile organic compounds (VOC) compliant (contain less than 250 grams of VOC per litre - less water). Paint must have a flash point of 61°C or higher. Paint Materials for each coating formulae to be premium quality products of a single manufacturer. Paint to be a mercury free formulation and shall not contain free formaldehyde. Paint shall contain no lead, cadmium, chromium, or other toxic heavy metal derivatives. Paint shall contain no fluorocarbons, chlorinated solvents or aromatic hydrocarbons.
- .4 In all mechanical and electrical rooms and in all areas where environment is painted or finished, paint all ducts, mechanical lines and equipment, excluding prefinished surfaces or brass. In mechanical rooms paint ducts Gloss White, while in other areas colour shall be as specified by Contract Administrator or shall match environment. Paint lines and equipment with colour code and identification markings outlined below. Colour and coating Materials of all other items to be painted shall be as directed by Contract Administrator and City.
- .5 All mechanical lines shall be identified with fluid service code identification stencil and arrow indicating direction of flow. These identification markings shall be painted onto line at maximum 6 metre intervals, at inlet and outlet points, before and after barriers, beside all valves and wherever else specified.
- .6 If possible, identification markings (lettering and arrow) shall be painted on at location which is visible and obvious to averaged sized viewer standing on floor. Colours shall be Gloss Black for natural gas, Gloss White for fire quenching service, and Gloss Yellow for radioactive wastes. For all other services colour shall be Gloss Black or Gloss White, contrasting solid colour background and matching existing system.
- .7 Do not paint non-ferrous and chrome-plated surfaces, stainless steel, aluminum, plastic, glass and prefinished surfaces, unless directed otherwise by Contract Administrator.
- .8 Prepare all canvas or canvas-like surfaces with one coat (2 mil dry thickness) of General Paints Enviroguard wall primer, a premium quality latex primer-sealer, prior to application of the two finish coats of enamel. Primer and coating Materials shall be compatible and by same manufacturer. In all finished areas, prepare, prime and paint all

exposed conduit to match the colour and finish coating of adjacent surfaces (environment).

- .9 The identification letter size in relation to the outside diameter of the line shall be as outlined below. Lines with diameters less than 19mm require only a directional arrow.

<u>Outside Diameter of Line (mm)</u>	<u>Size of Letter (mm)</u>
19 to 32	13
36 to 51	19
64 to 152	32

- .10 In architecturally unfinished areas, such as crawlspaces, where mechanical lines are normally not painted, colour code lines with minimum 300mm long solid colour band at maximum 6 metre intervals, at inlet and outlet points, before and after barriers and equipment, beside all valves and on each line at every access door. Identification markings (fluid service code identification stencil and directional arrow) shall be painted onto every band such that markings are visible and obvious to a viewer.

- .11 Paint and identify ducts, mechanical lines, equipment and miscellaneous metals, as follows:

<u>Service or Equipment</u>	<u>Colour Code</u>	<u>Fluid Service Code Identification Stencil and Colour</u>
Glycol heating supply	Purple Oriental Night	<b>G.H.S.</b> White
Glycol heating return	Purple Oriental Night	<b>G.H.R.</b> Gloss White
Natural gas lines (inches/lbs - pressure)	Yellow, Empire Yellow	<b>N. GAS</b> e.g. (5 psi) - indicate operating pressure Gloss Black
Pipe hangers, supports & pipe racks	Colour and finish coating to match adjacent surfaces. Confirm with Contract Administrator.	
Sprinkler lines	Deep Red Grenadier Red	<b>SPKR</b> Gloss White

**End Of Section**

**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.

**1.2               WORK INCLUDED**

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

**1.3               RELATED WORK SPECIFIED ELSEWHERE**

- .1 Section 21 05 00 Mechanical General Provisions
- .2 Section 21 05 10 Acceptable Materials & Equipment
- .3 Section 22 40 10 Plumbing
- .4 Section 22 50 10 Fire Protection
- .5 Section 23 60 10 Liquid Heat Transfer
- .6 Section 23 80 10 Air Distribution

**Part 2           Products**

**2.1               MATERIALS**

- .1 All Materials shall be equal in accordance with B7 in all respects to specified products and shall be used only in applications intended by the manufacturer. Materials not specifically intended for the purpose shall not be used. Approved Materials shall not be diluted or blended with other Materials unless specifically recommended by the manufacturer of the approved Material.
- .2 All final pipe and duct installations including insulation, covering and adhesive shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.
- .3 All canvas shall be treated to be fire retardant in accordance with ULC standards.
- .4 Wire to be 1.2mm (18 ga.) stainless steel, dead soft annealed, type 304.
- .5 U.L.C. label or satisfactory certified report from approved testing laboratory is required to indicate that fire hazard ratings for Materials proposed for use do not exceed those specified.
- .6 Flameproofing treatments subject to deterioration due to effects of high humidity are not acceptable.

- .7 Contract Administrator reserves the right to demand test samples of components of insulation systems for fire hazard test rating.

## **2.2 COMPATIBILITY OF COMPONENTS**

- .1 All adhesives, sealers, vapour coating, mastics, laggings and bedding compounds, shall be compatible with Materials to which they are applied. They shall not soften, corrode, or otherwise attack such Material in either wet or dry state and shall only be those recommended by manufacturer of insulation as suitable for application proposed. They shall be applied at ambient conditions acceptable to the manufacturer.

## **2.3 HOT INSULATION – GLYCOL HEATING**

- .1 Materials
  - .1 On piping 50mm (2") diam. and under, use 25 (1") Fibreglas 88 kg/m (5-1/2 lb./cu. ft) density pipe insulation with ASJ all service jacket and self seal lagging adhesive.
  - .2 On piping 62mm (2-1/2") diam. and larger, use 37mm (1-1/2") Fibreglas 88 kg/m (5-1/2 lb./cu. ft) density pipe insulation with ASJ all service jacket and self seal lagging adhesive.
- .2 Location
  - .1 Glycol heating piping.

## **2.4 INSULATION CLADDING**

- .1 Cover insulation with aluminum jacket CSA HA Series - M1980.
- .2 Embossed alloy jacketting 0.4mm thick with longitudinal slip joints and 50mm end laps with factory attached protective straps with mechanical fastener.
- .3 Jackets on fittings, 0.4mm thick, die shaped components of alloy with factory attached protective liner on interior surface.
- .4 Location
  - .1 All glycol heating piping in boiler room.
  - .2 All outdoor insulated piping and ductwork.

## **2.5 BREECHING INSULATION**

- .1 Insulate forced draft boiler breechings, including uptakes from boiler, with two 37mm (1-1/2") thick layers of Paroc 1200 premolded pipe insulation. Outer layer to be c/w all service jacket. Insulation to have a density of 192 kg/cu.m (12 lbs./cu.ft.).

## **2.6 VAPOUR BARRIER FLEXIBLE DUCT INSULATION**

- .1 Following duct externally insulated with Fibreglas RFFRK reinforced foil-faced vapour seal duct insulation PF335, 340 g. (3/4 lb./cu. ft.) density.
  - .1 50mm (2") Thickness
    - .1 All round supply and exhaust air ducts to/from MUAs/HRUs/EFs from roof back to within building for a length of 1.8m (6'-0").

- .2 All round ductwork located outdoors on roof.

## **2.7 VAPOUR BARRIER RIGID INSULATION**

- .1 Following ducts externally insulated with Fibreglas RFFRK reinforced foil-faced vapour seal duct insulation type FF 340 g. (4.5 lb./cu.ft.) density.
  - .1 50mm (2") Thickness
    - .1 All rectangular supply and exhaust air ducts to/from MUAs/HRUs/EFs from roof back to within building for a length of 1.8m (6'-0").
    - .2 All rectangular ductwork located outdoors on roof.

## **Part 3 Execution**

### **3.1 WORKMANSHIP**

- .1 Work shall be performed by licensed journeymen.
- .2 Apply insulation Materials, accessories and finishes in accordance with manufacturer's recommendations.
- .3 Do not apply coverings until hydrostatic tests have been completed, surfaces are free of grease, scale, moisture, and heat tracing where required has been installed. Insulation shall be clean and dry when installed and during application of any finish.
- .4 Apply insulation and coverings to equipment and piping which will operate with hot or warm liquid vapour, while surface is hot. Provide any required temporary heat to accomplish this.
- .5 Cold surfaces to be dry and ferrous surfaces to be coated with rust penetrating protective paint before applying insulation and vapour barriers.
- .6 Vapour barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, duct or seams, and without interruption at sleeves, pipe and fittings.
- .7 Install insulation with smooth and even surfaces, with round shapes laid to true circular and concentric shape, shaped to blend with fitting insulation and adjacent covering; with full length section and tight to insulated object.
- .8 Pack solid around all pipes where they pass through sleeves in walls, floor slabs, etc. for full thickness of floor with fibreglas or rockwool. Refer to firestopping clause where piping passes through fire separations. On all services, carry full insulation thickness through walls, floors, etc. Protect insulation of exposed pipes passing through floors with 1.2mm (18 ga.) galv. iron 150mm (6") from finished floor.
- .9 On piping, gouge out insulation for proper fit where there is interference between weld bead and insulation. Bevel insulation away from studs and nuts to permit their removal without damage to insulation. Closely and neatly trim around extending parts of pipe saddles, supports, hangers and clamp guides. Seal with insulating cement.
- .10 Use pipe covering protection saddles with roll type hangers unless otherwise indicated.

- .11 But joints
  - .1 Place joints on top of duct wherever practical. Butt joints on side of duct for flexible duct insulation.
  - .2 Adhere and seal laps of vapour barrier cover or vapour barrier strip of 100mm (4") minimum width furnished with insulation, using vapour seal adhesives.
- .12 Sagging of duct insulation will not be acceptable.
- .13 Stagger both longitudinal and horizontal joints, on duct insulation of multilayered construction.
- .14 Duct insulation with vapour barrier shall be continuous, except at fire dampers.
- .15 Ducts acoustically lined need no external insulation, unless specifically noted otherwise.
- .16 Existing duct and pipe covering damaged or cut back during installation Work to be made good with same insulation as specified for new Work.
- .17 Protect insulation against elements during all stages of application.
- .18 Do not cover manufacturer's nameplates. Cut insulation on 45 deg. angle to nameplate edge and seal.
- .19 Covering to be uniform in diameter, smooth in finish. Place longitudinal seams so as to be invisible.

### **3.2 HOT INSULATION – GLYCOL HEATING**

- .1 Insulate flanges, fittings and valve bodies, etc.
- .2 Fasten longitudinal laps with staples and seal with Swifts Adhesive #3218.
- .3 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.
- .4 Refinish exposed piping with canvas and coat with Bakor 120-18 white fire retardant lagging adhesive.
- .5 All fittings shall be insulated by wrapping with 25mm (1") thick layers of 12 kg/m<sup>3</sup>(3/4 lb./cu.ft.) density flexible fibreglass attached with jute twine. Surface shall be wrapped with Friction Tape and sealed with asphaltic sealing compound. Over this to be applied a smooth coating of insulating cement. Recover fittings with ASJ jacket applied directly over the smooth coat of cement. Brush coat with Bakor 120-18 white fire retardant adhesive.

### **3.3 INSULATION CLADDING**

- .1 For aluminum jacketing installation, install in strict accordance with manufacturer's published recommendations.

### **3.4 BREECHING INSULATION**

- .1 Insulate all fittings, etc. with sections of same Material as specified for breeching.

- .2 Fasten longitudinal laps with staples and seal with Swifts Adhesive #3218.
- .3 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.
- .4 Recover breeching insulation with 170 g. (6 oz.) canvas adhered with Bakor 120-18 white fire retardant lagging adhesive. Finish with brush coat of same adhesive.
- .5 Paint portions of uninsulated breeching steel and supports with two coats of high temp. black enamel.
- .6 Install insulation to allow for breeching expansion.

### **3.5 VAPOR BARRIER FLEXIBLE DUCT INSULATION**

- .1 Round Ducts
  - .1 Adhere to duct surface applied in strips 150mm (6") wide, 300mm (12") o.c. Butt all edges of insulation, staple and seal all joints with tape adhered over the joint. Seal all breaks with vapor barrier type.

### **3.6 VAPOR BARRIER RIGID DUCT INSULATION**

- .1 Insulation applied with edges tightly butted and secured by impaling on pins welded to duct. Pins to be staggered, minimum 300mm (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 vapor seal jacket with vapor barrier foil of the same quality as that of duct membrane 100mm (4") wide with BF 85-15 lagging adhesive.
- .3 Outdoor Ducts
  - .1 On square or rectangular ductwork provide slight peak along top centre line so moisture will run off.

**END OF SECTION**

**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 Provide labour, Material, equipment and services necessary for and incidental to the supply and installation of the systems shown on the Drawings and hereinafter specified.
- .2 Generally this shall include:
  - .1 Sanitary Drainage System
  - .2 Natural Gas Piping System

**1.3           RELATED WORK SPECIFIED ELSEWHERE**

- .1 Section 21 05 00 Mechanical General Provisions
- .2 Section 21 05 10 Acceptable Materials & Equipment
- .3 Section 21 08 10 Insulation
- .4 Section 22 50 10 Fire Protection
- .5 Section 23 60 10 Liquid Heat Transfer
- .6 Section 23 80 10 Air Distribution
- .7 Section 25 10 10 Controls/Instrumentation
- .8 Section 26 05 00 Common Work Results – For Electrical

**Part 2           Products**

**2.1           PIPE AND FITTINGS**

- .1 General
  - .1 All pipe & fittings shall be manufactured in Canada or the USA.
  - .2 Pipe and fittings shall conform to the standards listed in the applicable Building Code (latest revision).
    - .1 Flanged joints must have suitable gasket and bolts.
    - .2 Use brass nipples between copper piping and flush valves or c.p. brass goods.
    - .3 Where alternate piping Materials or jointing are specified a uniform type of pipe and fittings shall be used throughout each system.
  - .3 Drains - sanitary
    - .1 Drains and vent pipes shall be in accordance with local or provincial regulations with the following exceptions, unless otherwise specified.
    - .2 All cast iron soil pipe shall be class 4000.
    - .3 Cast iron soil pipe may be hub and spigot or mechanical joint. 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. Titan or approved equal in accordance with B7.

- .4 No plastic, asbestos cement or aluminum pipe will be accepted unless specifically called for by the Contract Administrator.
- .4 Natural Gas
  - .1 Pipe
    - .1 Up to 150mm (6"): - Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to ASTM A53 Grade B.
  - .2 Fittings
    - .1 Up to 50mm (2"):
      - .1 Screwed fittings - 1034 kPa (150 psi) black malleable iron, banded.
      - .2 Socket weld fittings - 13,800 kPa (2000 psi) forged steel.
      - .3 Unions - 1034 kPa (150 psi) brass to iron seat.
    - .2 64mm (2-1/2") and larger:
      - .1 Butt welding fittings to be manufactured to ASTM A234. Flanges to be forged carbon slip-on welding flanges conforming to ASTM A181, Grade 1. Gaskets to be spiral wound gasket "Wt" Series, carbon steel outer ring 304 stainless windings, flexible graphite filler. Site or shop cut gaskets unacceptable. Use ring gaskets on raised face flanges and full faced gaskets on flat faced flanges. Use 1034 kPa (150 psi) flanges on systems to 689 kPa (100 psi). Thread-O-Lets and Weld-O-Lets to be manufactured to ASTM A181, Grade 1.

## 2.2 VALVES

- .1 General
  - .1 Valve parts must be of Material recommended by mfg. for service specified. Valves must be installed with stems upright or horizontal, not inverted. Valves not specifically covered herein shall be of comparable quality to those specified.
- .2 Natural Gas
  - .1 Valves up to 50mm (2") size - Toyo 5044A and Kitz Code No. 58 ball valve or Newman Hattersley 1969F. Newman-Milliken 200M, lubricated screwed plug valve.
  - .2 Valves 64mm (2-1/2") and larger: Newman-Milliken 201M flanged plug valve. Newman-Milliken 200M, lubricated screwed plug valve.

## 2.3 CLEANOUTS

- .1 Cleanouts in cast iron soil pipe shall consist of cast iron ferrule with brass plug having raised head.
- .2 Cleanouts in copper drainage: Brass screwed plugs with raised head.
- .3 Cleanouts in cast iron screwed drainage fittings, (galvanized waste lines) shall consist of nipple and cap. Iron plugs not accepted. Exposed c.o. caps shall be chrome plated.

## 2.4 CLEANOUT ACCESS COVERS

- .1 Heavy traffic unfinished areas:
  - .1 Zurn Z-1425-24 heavy duty cast iron cover and frame, with securing screws.

## **2.5 PLUMBING EQUIPMENT**

- .1 General
  - .1 Provide traps, for all equipment.
  - .2 Heating Equipment:
    - .1 Connect drain to all heating systems and equipment wherever noted in the Specifications or on the Drawings.
- .2 Equipment
  - .1 Floor Drains
    - .1 FFD #1:
      - .1 Zurn Z-415-F cast iron floor drain, 3" x 9" (75mm x 225mm) polished nickel bronze strainer with one piece oval funnel with full port opening.

## **2.6 SANITARY DRAINAGE BELOW SLAB ON GRADE**

- .1 Refer to structural drawings for detail of sanitary piping below slab on grade in mechanical room.

## **Part 3 Execution**

### **3.1 GENERAL INSTALLATION**

- .1 Copper pipe shall not be buried except where specifically noted on Drawings.
- .2 All pipe shall be cut accurately to measurements taken at Site, installed without springing or forcing. All changes in direction made with fittings.
- .3 All connections to equipment made with unions or flanges.
- .4 Remove valve working parts during installation to prevent damage from heat where brazing, soldering, or welding is used.
- .5 Comply with latest CSA Standard W117.2 "Code for Safety in Welding and Cutting".
- .6 Drain pipes dropping into slab on grade shall have sisson joint arranged to take up movement of slab.
- .7 Run all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.
- .8 Co-operate with Contractor and all subcontractors to properly locate all equipment connections.
- .9 Provide a shutoff valve on supply connections at each piece of equipment.

### **3.2 DRAINAGE SYSTEMS**

- .1 Sanitary Drains
  - .1 Provide complete systems of sanitary drainage to serve all equipment. This includes local drains from equipment in Contract such as fan units, etc.
  - .2 Cleanouts:
    - .1 Install cleanouts at all changes of direction, at intervals of not over 15m (50') in horizontal runs, at all points where obstructions might be formed and at points required by plumbing regulations or shown on Drawings.

- .2 Cleanouts shall be accessible. Cleanouts above furred ceilings or in concrete slabs on grade shall be extended to floor level with cleanout access cover and frame.
- .3 Flash vents through roof in approved manner. Drains in floors shall be flashed or clamped to membrane water-proofing where required.

### **3.3 NATURAL GAS PIPING SYSTEM**

- .1 Run piping as shown to serve equipment. Take out permits and connect equipment ready for use. Provide gas regulators as specified under Products section of this Specification. Run vent piping from relief valves to atmosphere. Install gas piping in accordance with Provincial Department of Labour regulations. Provide gas cock at each piece of equipment. Provide drip pockets at each piece of equipment and at low points. Grade horizontal piping 1:500 (1" in 40 ft.) to drain through risers.
- .2 All natural gas piping concealed in walls or other inaccessible locations shall have all welded joints and shall be stamped by the welder with his number.
- .3 Where gas piping is welded, arrange with provincial authorities to inspect and provide written approval to Contract Administrator prior to system use.

### **3.4 JOINTING**

- .1 All joints shall be made in accordance with manufacturer's recommendations.
- .2 Fittings shall be braced where necessary to prevent joints coming apart under pressure.
- .3 Cast iron hub and spigot soil pipe may be joined with oakum and lead, or Bibby Bi-Seal compression sleeve. Do not use oakum on hot water drain lines where suspended in finished area.
- .4 Joints in Duriron or cast iron acid drainage piping shall be made with Durco rope and lead.
- .5 Screwed joints in steel piping shall be made with full cut standard taper pipe threads, with approved non-toxic joint compound applied to male threads only. Joint compound shall not be applied to the first thread. Avoid squeezing excess compound into pipes. All pipes must be reamed or filed and left full bore, clean and free of scale.
- .6 Pipe, joints, couplings, gaskets, and fittings, etc, shall be in strict accordance with manufacturers published recommendations.
- .7 Where black steel pipe and welding fittings are specified or permitted, welding to be performed by welder holding current welder's certificate from Provincial Department of Labour.

### **3.5 EXPANSION AND CONTRACTION OF PIPING**

- .1 Make provision for expansion and contraction of all piping. Use swing connections where shown or necessary.
- .2 Install expansion joints where required. Provide anchors and guides as recommended by manufacturer.

### **3.6 CLEANING AND FLUSHING**

- .1 On completion, flush out piping systems before installation of equipment, etc. in order to remove any foreign Material in piping.

- .2 Clean out all equipment and leave in first class operating condition.

**3.7 TESTING**

- .1 All piping systems shall be pressure tested as follows:
  - .1 Plumbing, drainage and natural gas systems - in accordance with local regulations.
  - .2 General
    - .1 All systems and equipment will be subject to operating tests to verify that they operate properly, as directed by Contract Administrator. This will apply to pumps, heaters, compressors, and complete systems generally.
    - .2 Contract Administrator's representative shall witness tests. Give 48 hours notice in advance of all tests.

**END OF SECTION**

**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       Labour, Material, plant, tools, equipment and services necessary and reasonably incidental to completion of fire protection Work, including:
  - .1       Sprinkler System
  - .2       Modification to existing Sprinkler Systems
  - .3       Preparation of Shop Drawings, approval of same by authorities having jurisdiction, inspection, testing and approval as specified herein and as required by authorities having jurisdiction.

**1.3               RELATED WORK SPECIFIED ELSEWHERE**

- .1       Section 21 05 00 Mechanical General Provisions
- .2       Section 21 05 10 Acceptable Materials and Equipment
- .3       Section 21 08 10 Insulation
- .4       Section 22 40 10 Plumbing
- .5       Section 23 60 10 Liquid Heat Transfer
- .6       Section 23 80 10 Air Distribution
- .7       Section 25 10 10 Controls/Instrumentation
- .8       Section 26 05 00 Common Work Results – For Electrical

**Part 2           Products**

**2.1               MATERIALS**

- .1       General
  - .1       All pipe & fittings shall be manufactured in North America.
  - .2       All Materials shall be in accordance with requirements of the applicable NFPA fire codes including NFPA #13 - Sprinkler Systems.
  - .3       All Materials shall conform to standards listed in the current edition of applicable Building Codes.
  - .4       All equipment and components, shall be listed, labelled and approved for intended use by Underwriters Laboratories of Canada (ULC), Underwriters

Laboratories (UL), or Factory Mutual (FM), and meet with approval of the authority having jurisdiction.

.2 Pipe

- .1 Steel pipe to meet requirements of NFPA #13 - Sprinkler Systems in all respects and meets requirements of ASTM A53 - welded and seamless pipe.
- .2 All pipe in sprinkler and standpipe systems shall be schedule 40 black steel pipe and meets requirements of ASTM A53 - welded and seamless pipe.
- .3 Pipe 2" and smaller shall be joined by threaded connections or welded.
- .4 Pipe 2-1/2" and larger shall be joined by roll groove mechanical couplings or by welding.

.3 Fittings

- .1 Weld fittings up to including 1-1/2" shall be 13,790 kPa (2,000 psi) socket, 2" and larger shall be butt weld.
- .2 Grooved pipe couplings shall be Victaulic 'Zero Flex' Style 07 rigid couplings. Anvil Rigid Lock 7401 considered equal in accordance with B7.
- .3 Mechanical grooved, couplings and gaskets used on dry or preaction systems shall be listed for dry pipe service.
- .4 Threaded fittings shall be standard weight cast iron. Saddle type fittings not acceptable. All fittings to be suitable for a working pressure of 1,210 kPa (175 psi).
- .5 Pipe flanges shall be Class 150 forged steel except for welded pipe connections, flanges for pipe 64mm (2-1/2") or larger shall have grooved extension for connection to pipe using Victaulic coupling; flanges for pipe 50mm (2") and less shall be threaded. Slip on or welding neck flanges may be used on shop fabricated components. Valve companion flanges to be flat or raised face to suit valve flange. Provide suitable red rubber ring or full face gasket, machine bolts and hex nuts unless otherwise recommended by manufacturer of connecting valve or equipment.
- .6 Victaulic F.I.T. fittings Victaulic style 922 Hooker, and Victaulic Snap-Let sprinkler head connection fittings shall not be used.

.4 Valves

.1 Ball Valves

- .1 Up to including 2" - Victaulic Series 728 firelock ball valve, bronze body, chrome plated brass ball, stainless steel stem, TFE seat, wheel handle actuator with valve position indicator c/w double pole double throw supervisory switch, underwriters and FM approved. Working pressure 2,413 kPa (350 psi).

.2 Butterfly Valves

- .1 2-1/2" and larger - Iron body lug style valve with aluminum bronze disc and replaceable EPDM seat. Manual gear operator with valve position indicator. Valve rated for 1,379 kPa (200 psi) operating pressure. Anvil LC8282-3-FD with two internal SPDT monitor switches.
- .2 2-1/2" and larger - Victaulic Series 705W, ductile iron body, EPDM coated ductile iron disc, weatherproof actuator, with valve position indicator c/w double pole double throw supervisory switch, Underwriters

Listed and FM approved, working pressure 2,069 kPa (300 psi). Anvil Series 7700 Grovlok considered equal in accordance with B7.

- .3 Gate Valves
  - .1 Gate valves 4" to 6" - Iron body bronze mounted gate valves, OS & Y pattern with flanged ends, rated for 1,380 kPa operating pressure. Crane No. 10269, Underwriters and FM approved.
- .4 Check Valves
  - .1 Victaulic Series 717 Firelock check valve, ductile iron body, EPDM disc coating, ULC listed.
- .5 Sprinkler Heads
  - .1 In unfinished areas or in areas where sprinkler piping cannot be concealed sprinkler heads shall be bronze upright unless noted otherwise on Drawings. Provide bronze sidewall type where noted.
  - .2 When sprinklers are exposed to damage, fit with approved wire guards.
  - .3 Rapid response sprinkler head design shall be provided at locations required by NFPA and local Code.
- .6 Hangers and Supports
  - .1 Sprinkler system shall be in accordance with NFPA #13 and/or Section 21 05 00 Clause `Hangers and Supports' whichever is most stringent application.

### **Part 3 Execution**

#### **3.1 QUALIFICATION OF SUBCONTRACTOR**

- .1 Only experienced Fire Protection Subcontractors, as determined by Contract Administrator, will be considered for this Work. Subcontractors must be able to show evidence of having performed Work of similar type and size.

#### **3.2 SHOP DRAWINGS, PERMITS, FEES**

- .1 Prior to installation, prepare complete set of detailed Shop Drawings in accordance with requirements of NFPA Standard #13, and inspecting authority. Information as to architectural, structural, mechanical and electrical systems shall be obtained from respective Drawings and/or from Site. Carry out any necessary flow tests without extra compensation.
- .2 Detail design shown on Shop Drawings shall conform to general piping layout and sprinkler arrangement shown on Drawings. Contract Administrators approval is required for alternative designs or revisions other than as required for co-ordination with other trades and existing Site conditions.
- .3 At completion of Work, provide two (2) sets of "As-Built" Drawings with all changes incorporated.
- .4 Submit Shop Drawings and calculations to Contract Administrator for review and to inspecting and inspection fees. Inspecting authorities for this project will be:
  - .1 Local building inspection department and/or fire department.

- .2 The City's Insurance Underwriters.
- .3 Provincial Fire Commissioner.
- .4 Fire Commissioner of Canada.
- .5 Insurer's Advisory Organization (I.A.O.).
- .5 Arrange for inspection and testing of all Work, and make any changes required to comply with regulations of inspecting authority.
- .6 Systems shall be designed in accordance with requirements of:
  - .1 The City's Insurance Underwriters ( ).
  - .2 National Building Code.
  - .3 Manitoba Building Code and Manitoba Fire Code
  - .4 Local building regulations
  - .5 All applicable NFPA Codes & Standards

### **3.3 EXAMINATION OF DRAWINGS AND CO- OPERATION**

- .1 Examine all Drawings before preparing Shop Drawings. Arrange position of sprinkler heads, pipes, etc. as required to prevent interference with Work of other trades, and existing conditions.
- .2 Co-operate with all other Subcontractors and/or Subcontractors installing equipment which may affect proper installation and operation of Work and arrange sprinkler heads, etc. in proper relation to other apparatus, such as lighting fixtures, unit heaters, air inlets, air outlets etc., both new and existing.
- .3 Provide wiring diagrams, dimensions of concrete bases, dimensions of masonry openings, etc. as required by other Subcontractors and/or Subcontractors.

### **3.4 EXISTING CONDITIONS**

- .1 Before commencement of any Work, examine Work of other trades and make immediate report to Contract Administrators of any defect or interference affecting Work or guarantee of this Work.
- .2 In case of buildings or Site conditions existing prior to tendering, examination and report must be made at least seven (7) Working days prior to closing of Bid Opportunity, otherwise existing conditions will be considered acceptable to Section 22 50 10, and no later allowance will be made for extras relating to these conditions.
- .3 Contract Administrator will arrange Site visit to allow bidders to inspect existing conditions during Bid Opportunity period. Contact at for details.

### **3.5 PIPING SYSTEMS**

- .1 Inside of all pipe, fittings, valves and all other equipment to be left smooth, clean, and free from blisters, loose mill scale, sand and dirt.
- .2 Install unions or flanges at all equipment connections, valves, etc.

- .3 Install dielectric insulating couplings between all pipes or apparatus constructed of dissimilar metals.
- .4 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 section replaced with fittings if bending is not satisfactory.
- .5 Cut all pipe accurately to measurements taken at Site, and shall be installed without springing or forcing.
- .6 Run all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.
- .7 All pipe concealed in walls or inaccessible spaces shall have welded joints.
- .8 Welded pipe sections shall be shop fabricated as far as possible and/or to minimize field welding required. Welding on Site is not permitted except with special approval of authorities having jurisdiction. If Site welding is required obtain written approval of authorities having jurisdiction and follow all safety precautions required by such authorities.

### **3.6 HOLES IN STRUCTURAL MEMBERS**

- .1 If drilling of structural beams or other load bearing members is required by design or by Site conditions for passage of piping, obtain Contract Administrator approval for location and proposed drilling procedure before drilling. Drill only in locations previously approved by Contract Administrator. Where drilling required by design or existing Site conditions be responsible for carrying out same to approved procedure.
- .2 Do not cut or install piping until final drilling locations are approved by Contract Administrator. Section 22 50 10 will not be reimbursed for extra cost incurred to relocate piping previously installed on basis of unapproved drill locations.

### **3.7 HYDRAULIC DESIGN**

- .1 Section 22 50 10 shall have option of using hydraulic design in preparing Shop Drawings for system. In some cases hydraulic design may be required by job conditions or by authority having jurisdiction. In any case, it shall be responsibility of Section 22 50 10 to carry out necessary calculations, and to submit calculations, data, and Drawings in accordance with requirements of NFPA Standard #13 and authority having jurisdiction.

### **3.8 TESTING**

- .1 Provide all labour, Material, equipment, etc. as required to carry out testing as specified herein and as required by authorities having jurisdiction to prove satisfactory completion, performance and acceptance of all systems.
- .2 Testing shall include:
  - .1 Flow Test
  - .2 Pressure Test
  - .3 Inspectors Tests

- .3 Conduct flow tests on water systems as required by authority having jurisdiction.
- .4 Pressure Tests
  - .1 Perform pressure tests on all new or modified piping systems to requirements of NFPA #13, authority having jurisdiction, and additional requirements noted in this Specification.
  - .2 All systems shall be pressure tested after final completion. If subsequent modifications are necessary; eg. relocation of sprinkler drops or similar minor revisions, pressure tests shall be repeated as directed by Contract Administrator.
  - .3 Sprinkler mains and branch piping above new ceilings shall be pressure tested and all leakage repaired before installation of ceiling tiles.
  - .4 Final pressure test shall be carried out after installation of sprinklers.
  - .5 In addition to hydrostatic pressure tests noted above, and operational tests noted below, all pre-action sprinkler systems shall be subjected to a pneumatic pressure test. This test shall be carried out after satisfactory completion of operational tests noted below. On completion of operational tests, drain entire pre-action system including each sprinkler drop leg (pendant sprinklers). Replace all sprinkler heads and test system under 175 kPa (40 psig) air pressure for 24 hours. Test shall be considered satisfactory when observed pressure drop is less than 10 kPa (1.5 psig) over 24 hour period.
- .5 Inspectors Tests
  - .1 Inspectors tests shall be performed at all dry pipe, preaction and alarm check valve stations, and at all zone stations, flow switches, etc., and at other locations as required by authority having jurisdiction.
  - .2 Tests shall prove satisfactory operation of all flow switches and other alarm devices and all fire detectors connected to preaction system.
- .6 Documentation
  - .1 Section 22 50 10 shall properly document all testing distribute same to all authorities having jurisdiction, Contract Administrator, and The City. Testing shall be repeated as required until acceptable results obtained as determined by authority having jurisdiction and Contract Administrator.
  - .2 On completion on inspections and testing submit to Contract Administrator and authorities having jurisdiction completed signed copies of appropriate NFPA-13 Contractor's Material & Test Certificate, Forms 85-A and 85-B.
- .7 Advance Notice of Testing
  - .1 Arrange suitable times with authorities having jurisdiction, Contract Administrator and The City in advance of all testing so that all have opportunity to witness testing.
- .8 Activation
  - .1 All systems shall be left in normal active duty condition immediately following satisfactory completion of testing.

- .9 Warranty Inspection/One Year Test
  - .1 Provide complete inspection/test one year after final acceptance of systems. Annual tests required by NFPA 25 to be conducted at this inspection. Submit report to The City and Contract Administrator.

**END OF SECTION**