

**Part 1 General**

**1.1 SCOPE OF WORK**

- .1 **All drawings and all sections** of the specifications including all addenda, apply to and form an integral part of this section.
- .2 Work to include all labour, material and equipment required for installing, testing and placing in initial operation the mechanical systems and equipment as detailed in each section of specifications and as shown on drawings or shown on Mechanical Drawings or elsewhere.
- .3 All Mechanical Work to be bid as a single complete sub-contract as defined in Division 01 even though work of various mechanical trades has been sub-divided into separate sections.

**1.2 RELATED REQUIREMENTS**

- .1 Submittals: Division 01.
- .2 Temporary Facilities: Division 01.
- .3 Temporary Heat: Division 01.
- .4 Contract Acceptance Procedures: Division 01.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 Services connections: Division 01.
- .2 Painting, colour coding and identification of mechanical work: Section 09 91 30.
- .3 Electric motor power characteristics: Division 26.

**1.4 LIMITATIONS OF DRAWINGS AND SPECIFICATIONS**

- .1 Drawings are diagrammatic and approximately to scale. They are intended to define quality, scope and to provide general guidelines. They are **not** intended to provide detailed installation instructions. They establish scope, material and quality and are not detailed instructions that define every offset, fitting, valve, or every difficulty encountered during execution of work.
- .2 Field verify all building and site dimensions prior to any fabrication and installation of equipment or materials. No contract revisions will be considered for failure to verify these dimensions on site.
- .3 Refer to architectural drawings for exact building and site dimensions.

- .4 Review drawings and specifications prior to any fabrication or installation and notify the Departmental Representative of any areas requiring further clarification. Do not attempt any fabrication or installation until such clarification is provided.

## **1.5 INTENT**

- .1 Provide complete and fully tested operational mechanical systems to meet the requirements described herein and in accordance with applicable Codes and Ordinances.
- .2 Conform to manufacturer's instructions, details and procedures for equipment installations.
- .3 Install piping and ductwork generally in locations and routes shown on the drawings, close to building structure. Minimized furring requirements and interference with other services or free space. Remove and replace improperly installed equipment. Install all piping and ductwork in concealed spaces unless noted otherwise.
- .4 Follow the recommended installation details and procedures for equipment as found in suppliers technical data, supplemented by details given herein and on plans, which in turn shall be subject to the approval of Departmental Representative.
- .5 Provide additional material for modifications that may be required to correct minor job conflicts.
- .6 Provide adequate clear space for future or Departmental Representative supplied equipment and connections for such equipment. If required by Departmental Representative provide detailed layouts for checking and approval before commencing work.
- .7 Plumbing fixtures shown on Architectural drawings and not on Mechanical drawings shall be supplied and installed by the Mechanical Sub-Contractor with all necessary piping for the complete operation of the fixture. Check all architectural drawings during the tendering period.
- .8 Spaces reserved for equipment noted as future, to be left clear, as noted on drawings, so that future connections can be made.
- .9 Refer to Architectural drawings for construction details. These shall be used to relate to roof supports, piping and duct penetrations in walls, roof and other building construction.
- .10 Reference standards and building codes referred to in this specification shall be understood to be the latest edition, or the edition currently in force, for that document.
- .11 Review drawings and specifications while preparing tender estimate and notify the Departmental Representative of any areas requiring clarification. Failure to acquire clarification from the Departmental Representative does not relieve the Contractor from compliance with the intent of the design or the contract documents.

## **1.6 QUALITY ASSURANCE**

- .1 Replace materials less than specified quality or as designated by Departmental Representative and relocate work incorrectly installed as determined by Departmental Representative.
- .2 Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.
- .3 Install material and equipment using qualified trades people.

## **1.7 LAYOUT AND COORDINATION OF WORK**

- .1 Assume responsibility for laying out work and for damage caused by improper execution of work.
- .2 Examine Structural, Architectural, 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 the Departmental Representative's attention, in writing, prior to closing of tenders.
- .3 Prepare and submit drawings showing sleeving, recessed and formed holes required in concrete for mechanical work. Drawings shall be to a scale sufficient to show necessary details.
- .4 Properly dimension all sleeves, recesses and openings with respect to building elevations and established grid lines.
- .5 Prepare drawings in conjunction with other trades. Drawings shall be to a scale sufficient to show the necessary details. Submit for review using the same procedures as specified for shop drawings.
- .6 Prepare fully dimensioned detail drawings of all shafts, duct spaces and pipes spaces. Show all holes and sleeves and include information pertaining to access, clearances, tappings, drains and electrical connections.
- .7 This Contractor shall produce a series of shop drawings called "Interference Drawings" for areas of shafts, rooms and ceilings which are highly congested and for which site workers could not solve construction coordination issues early on. These drawings are to propose solutions for all trades affected. Duct equivalents and alternate routes are to be proposed to and approved by the Departmental Representative. Submit prior to ductwork fabrication.

## **1.8 MAINTENANCE ACCOMMODATION**

- .1 Install all equipment such as valves, motors, traps, dampers, etc., in a manner to facilitate proper maintenance and ease of repair or replacement.
- .2 Locate flanges and unions in such a manner that any piece of equipment can be removed and replaced without major pipe cutting and removal.

- .3 Build any ductwork which may interfere with the maintenance or repair of equipment so that it can be readily removed or hinged out of the way.
- .4 Provide grease cups, lubrication fittings, etc. Provide extensions to outside of fan cabinets.
- .5 Provide maintenance platforms, etc., to facilitate maintenance of equipment which is not readily and safely accessible.
- .6 Provide Lifting Eyes and Hooks:
  - .1 Ensure that all motors and components weighing over 68 kg are equipped with a lifting eye or lug.
  - .2 Where equipment is not in banks, provide two eye hooks above each piece of equipment.

#### **1.9 EQUIPMENT SUPPORTS**

- .1 Design, construct and install metal supports, stands, platforms and other metal structures required for and associated with the mechanical equipment. Ensure that structures are designed so that loads and impact loads are properly distributed onto building structure.
- .2 Where equipment is indicated or specified to be floor mounted on stands or legs, fabricate these from structural steel section and/or steel pipe with adequate bracing and steel plate flanges for bolting to the concrete housekeeping pad.
- .3 Where ceiling or wall mounting is indicated or specified, use a suspended platform, bracket or shelf, whichever is most suitable for the equipment and its location. Fabricate from standard structural steel sections and plate and/or steel pipe. Ensure that these structures are adequately fastened to the building structure.
- .4 Supports must be large enough to support the equipment along the entire length and width. Adequate provision must be made to install isolators if necessary either below the support or between support and the equipment.
- .5 Refer to Section 23 05 29, for insert requirements, applicable to all piping, ductwork and equipment supports.

#### **1.10 ANCHOR BOLTS**

- .1 Provide and set anchor bolts, sleeves, washers, nuts and provide templates to locate the positions of the bolts. Set sleeves so that they are flush with or slightly above the top surface or rough concrete. Use anchor bolts with adequate right-angles bends or hooks, or with square plate washers, threads and nuts for anchoring. Do not use expansion shields or similar devices for anchoring mechanical equipment to concrete bases.

### **1.11 MATERIALS AND EQUIPMENT**

- .1 Mechanical equipment and materials shall be in accordance with the following requirements.
  - .1 Equipment and materials shall be new and have design characteristics as specified.
  - .2 Equipment and materials shall conform to space limitations and shall not require redesign of any parts of the structural, mechanical, electrical, or architectural layout.
  - .3 Materials selected for a particular type, class, or service shall be of one manufacture. No indiscriminate mixing of manufacturers will be allowed.

### **1.12 WORKMANSHIP**

- .1 Employ tradesmen fully qualified under Federal, Provincial and Municipal regulations pertaining to the licensing and qualifications of tradesmen.
- .2 Only first class workmanship will be accepted, not only as regards to safety, efficiency, durability, etc., but also as regards to the neatness of detail. Pipe work and ductwork must be lined up parallel to, or at right angles to building walls. Equipment must be accurately set, plumbed and welded, and hanger rods must be similar in true vertical adjustment. The entire work shall present a neat and clean appearance on completion.
- .3 Building code requirements and/or manufacturer's written recommendations will be considered the minimum requirements of this specification. Where standards in excess of these are required they are noted in this specification.

### **1.13 EXAMINATION OF SITE**

- .1 The Mechanical Sub-Contractor must examine the building site, existing adjacent buildings, and the services to be provided and shall satisfy himself that the work under this contract may be satisfactorily carried out without changes to the Contract Documents.
- .2 No expense incurred by the contractor through his failure to make these examinations will be allowed for. Any errors found as a result of the examinations must be brought to the attention of the Departmental Representative, in writing, before closing the tenders.

### **1.14 EQUIPMENT PROTECTION AND CLEAN-UP**

- .1 Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush out bearings and refill with new charge of lubricate, before final acceptance.

- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions.
- .5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .6 Remove all tools, surplus and waste materials from the building site upon completion. Clean all grease, dirt and excess material from walls, floors, ceilings and fixtures for which this Sub-Contractor was responsible, and leave the premises suitable for immediate use.
- .7 Ensure that existing equipment is moved without damage or loss; dismantle carefully, package and store loose components as necessary. Do not use existing materials or equipment unless specifically indicated.

#### **1.15 PERMITS, CERTIFICATES, CODES AND FEES**

- .1 Give necessary notices, obtain necessary permits and pay required fees and taxes in order that the work under this contract may be carried out.
- .2 Be responsible to file the necessary plans, to prepare for and obtain approval of documents as required by authorities having jurisdiction and to obtain certificates of inspection required. Deliver prior to request for acceptance and final payment for the work.
- .3 Work and materials shall be in complete accordance with the approval of local codes and authorities having jurisdiction.

#### **1.16 RECORD DRAWINGS**

- .1 Refer to Division 01, Project Close-out.
- .2 Obtain an extra set of prints and use solely for the purpose to mark on all changes and deviations in runs of piping or ductwork or in the location of equipment as the job progresses. This set shall be kept up to date and shall constitute a complete record set of the installed equipment and materials at the completion of the project.
- .3 Record drawings shall identify location of fire dampers, major control lines, access doors and tagged valves.
- .4 At substantial performance of the Contract, turn the record drawings over to the Mechanical Sub-Construction Manager. Clearly mark the drawings, "Record Drawing", stamp with the name of the Mechanical Sub-Contractor, with name and signature of the responsible representative of the Mechanical sub-Contractor.
- .5 Furnish record drawings of sprinkler systems and control diagrams; piping and duct layout drawings may be requested by the Departmental Representative.
- .6 Indicate references to addenda and Change Order revisions.

- .7 Transfer the record information, addenda and Change Order revisions to the reproducible copies of the original drawings furnished. Do all lettering fonts and line work in a manner equivalent to that of the original drawings.

#### **1.17 JOB SUPERINTENDENT SUPERVISION**

- .1 Employ a competent superintendent on the job site throughout the complete execution of the contract. This Superintendent shall have full charge of the work and shall be responsible to see that the work of all sub-trades is properly carried out in accordance with the standards set forth in the drawings and specifications.
- .2 The Superintendent shall not be changed during the course of the job unless he proves to be unsatisfactory to the Departmental Representative or the Mechanical Sub-Construction Manager, or if he ceases to be employed.

#### **1.18 SHOP DRAWINGS**

- .1 Refer to Division 01, Submittals.

#### **1.19 ABBREVIATIONS**

- .1 Abbreviations used in this specification are common to and in general use within the related trades.

#### **1.20 TEMPORARY OR TRIAL USAGE**

- .1 Departmental Representative 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 the Departmental Representative 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 the 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.
- .2 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 and pay all costs for air filter cleaning service. Filters to operate between pressure drops noted in filter manufacturer's catalogue.
- .3 Take responsibility for damage caused by defective material or workmanship during temporary or trial usage by the Departmental Representative.

#### **1.21 SUBMISSIONS FOR OPERATING AND MAINTENANCE MANUALS**

- .1 Submit material for operating and maintenance brochures on all mechanical equipment for inclusion in operating and maintenance manuals described in Division 01. Include complete operating and maintenance instructions, shop drawings as previously submitted and reviewed by the Departmental Representative and complete catalogue information.

- .2 Submit material to meet the requirements of the Departmental Representative.

## **1.22 SEMI-FINAL AND FINAL INSPECTIONS**

- .1 Refer to Division 01, Contract Close-out.
- .2 A semi-final inspection will be carried out prior to final inspection. Advise the Departmental Representative in writing, approximately ten (10) working days prior to the anticipated final inspection date so that this semi-final inspection may be carried out.
- .3 Perform the following items prior to semi-final inspection. Provide declaration in writing that the items listed are completed:
  - .1 Heating and ventilation systems capable of operation with alarm controls functional and automatic controls generally in operation, but not necessarily finally calibrated.
  - .2 Necessary tests on equipment made including tests required by authorities and certificates of approval obtained.
  - .3 Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed.
  - .4 Equipment lubricated as per manufacturer's data.
  - .5 Warranty forms have been mailed to manufacturer. Submit a copy of the original warranty for equipment which has warranty period longer than one year.
  - .6 Submit sample of Operating/Maintenance Manuals. Arrange operating and maintenance instructions, and submit schedule for approval.
  - .7 Review and ensure that access doors are suitably located and equipment easily accessible included plumbing cleanouts.
  - .8 Noise and vibration control devices and flexible connections inspected by the manufacturer's representative and written report submitted.
  - .9 Equipment alignment carried out by qualified millwright and certified report submitted.
  - .10 Fan plenums cleaned and temporary filters removed and permanent filters installed.
- .4 Prior to semi-final inspection, provide complete list of items which are either not finished or deficient at the time of the semi-final inspection.
- .5 Provide declaration in writing that semi-final deficiencies and the following items have been completed prior to the final inspection:
  - .1 Equipment cleaned inside, outside and lubricated. Plumbing fixtures and brass cleaned.

- .2 Final calibration of controls completed.
- .6 Excessive deficiencies will not be tolerated. Should, an excessive number of inspections be required due to the Contractor's, delay in completing the work, charges for Departmental Representative's time required to review the deficiencies may be levied against the Contractor.

### **1.23 CUTTING AND PATCHING**

- .1 Locate and provide holes and sleeves required for mechanical work. Relocate improperly located holes and sleeves at no additional cost to the contract.
- .2 Patch building where damaged from equipment installation improperly located holes. Use matching materials specified in the respective section to result in construction, concealed and visible, equivalent to the original intent and exact in external appearance.

### **1.24 WATERPROOFING**

- .1 Where any waterproofing membrane must be pierced by the work, reseal the opening using a method approved by the Departmental Representative prior to doing the work. Furnish and install sleeves, caulking and flashing subsequently required.

### **1.25 INSPECTIONS**

- .1 Contractor's work will be inspected periodically by the Departmental Representative solely for purpose of determining general quality of work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and specifications to assist them to carry out work. Inspection and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon the Departmental Representative any responsibility to supervise or oversee erection or installation of any work.

### **1.26 PROJECT SCHEDULE**

- .1 Schedule work strictly in accordance with project schedule and phasing outlined in Division 01 and all associated costs included.

### **1.27 MECHANICAL INFORMATION ON TENDER DOCUMENTS**

- .1 Refer to Division 01.
- .2 Complete all mechanical information required for completion of tender form, and submit with tender.
- .3 Provide separate prices for items listed on the mechanical information sheet and tender form.
- .4 It is **extremely** important that these prices be as accurate as possible since they are used by the Departmental Representative in their financial assessments.

## **1.28 SECURITY FASTENERS**

- .1 The use of security fasteners is required on all exposed mechanical equipment, grilles, cabinets, fixtures, covers, and access panels.
  - .1 Acceptable material: Textron Fastening Systems Inc. Torx pin head.

## **1.29 OPEN WEB STEEL JOIST LOADING**

- .1 No mechanical equipment is to be supported from the roof joists.
- .2 The Mechanical Contractor is to ensure that piping, ductwork and equipment are supported in such a manner so that the structural concentrated load allowance of 3.0 kN is not exceeded.

## **1.30 INDOOR AIR QUALITY MANAGEMENT PLAN DURING CONSTRUCTION**

- .1 Do construction indoor air quality management in accordance with the Construction Indoor air Quality Management Plan.
- .2 The intent of this plan is to prevent construction and future indoor air quality problems that may result from construction affecting the comfort and well being of construction workers and building occupants.
- .3 Protection:
  - .1 Use of air handling units, fans or any associated equipment and systems for ventilation, heating, de-humidification, humidification, dust control or any other use during construction is strictly prohibited.
  - .2 Seal off all supply, return and exhaust air system openings to prevent the accumulation of dust and debris in the systems at all times unless work is being completed on the immediate area of the system using plastic seals to the approval of the Departmental Representative. This is to include overnight and longer work stoppages. All diffusers and grilles are also to be sealed in plastic.
  - .3 Keep all operable doors on all air handling units closed at all times.
  - .4 Do not store construction or waste materials in Fan and Mechanical Rooms or inside ventilation units or ducts.
  - .5 Where ducts become contaminated due to inadequate protection, these ducts will be cleaned professionally as specified in Section 23 01 30 – Ductwork Cleaning.
- .4 Housekeeping:
  - .1 Provide special emphasis on HVAC equipment and duct systems to remove contaminants from the systems prior to operation of any permanent ventilation equipment.

- .2 Keep all coils, filters, fans and ductwork clean during installation as specified and clean all prior to performing the Testing, Adjusting and Balancing of the systems.
- .3 Remove accumulations of water inside the equipment during construction. Protect all porous materials such as insulation and ceiling tile from exposure to moisture.
- .4 Duct cleaning to the requirements of Section 23 01 30 – Ductwork Cleaning.

**END OF SECTION**