Part 1 General

1.1 INTENT

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

.2 Provide fully tested and operational mechanical systems in complete accordance with applicable codes and bylaws.

.3 Contract documents of this section are diagrammatic. They establish scope, material and installation quality and are not detailed installation instructions. Do not scale from the drawings, exact dimensions are to be taken from the site.

.4 Follow Manufacturer's recommendations for installation supplemented by contract documents, unless otherwise specified by the Contract Administrator. Any discrepancies must be brought to the Contract Administrator's attention in accordance with B4.

.5 Connect to equipment specified in other Sections. Uncrate equipment, move into place, install complete, start-up, test and commission.

.6 Division 1 shall apply to work in this section.

1.2 SCOPE OF WORK

.1 Work to include labour, materials and equipment required for installing, testing, adjusting, balancing and commissioning of the mechanical systems and the provision of As-built drawings, O&M Manuals and personnel training as detailed in this and other Sections of Division 22 and 23.

.2 In general, Work in this Division includes the provision and installation of the following:

.1 Louvers for intake and relief venting and related hardware.

.2 Modulating dampers and related actuators and hardware.

.3 Filter (FIL-Z602) and supply fan (SF-Z603) and related hardware.

.4 Duct heating coil (HCE-Z004) and related controls and hardware.

.5 Insulated and jacketed ductwork.

.6 Supply and relief grilles and related hardware.

.7 Two ground floor unit heaters (UH-Z606 and UH-Z607) and related controls and hardware.

.8 One dry well unit heater (UH-Z608) and related controls and hardware.

.3 It is the responsibility of the General Mechanical Contractor to co-ordinate the work among the various sub-trades to ensure complete functioning systems.

1.3 CO-ORDINATION OF WORK

.1 Make reference to all drawings when setting out Work. Consult with respective Divisions and the Contract Administrator to ensure the Work is correctly installed. Jointly resolve all conflicts on-site before fabricating or installing any materials or equipment.

.2 Accuracy of dimensions for new piping, flanges, valves and other equipment items is the Contractor's responsibility. Any fit issues between Site conditions and new materials to be installed remain with the Contractor.

.3 Where dimensional details are required, collect Site dimensions and coordinate with the applicable drawings.

1.4 QUALITY OF WORK

.1 Maintain qualified job site personnel consisting of licensed tradesmen and registered apprentices with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

.2 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates.

.3 Only first class workmanship will be accepted, not only as regards to safety, efficiency, and durability but also as regards to neatness of detail. Pipework must be installed parallel to, or at right angles to building planes. The entire work shall present a neat and clean appearance on completion.

.4 Work which does not conform to standards accepted by the Contract Administrator and the trade may be rejected.

1.5 QUALITY ASSURANCE

.1 Quality assurance submittals: submit the following in accordance with Division 1.

.2 Health and Safety

.1 Perform construction occupational health and safety in accordance with the Contractor's COR Safety Program and the requirements of the Authority Having Jurisdiction.

1.6 STANDARDS OF MATERIALS

.1 All materials and equipment installed under this contract shall be new unless otherwise noted.

.2 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 price shall be based on the use of materials and equipment as specified.

.3 Provide new material and equipment of first class quality, delivered, erected, connected and finished in every detail, and supplied with the acceptance of the Contract Administrator. Assume responsibility of ensuring that provided equipment performs as specified.

.4 In the preparation of the Bid, if a Subcontractor neglects to name the manufacturer where accepted equals have been shown, it will be understood that the specified equipment will be provided.

.5 Request for approval of equals must be in accordance with B7.

.6 Assume full responsibility for ensuring that, when providing accepted equals, all space, weight, connections, power and wiring requirements, etc. are considered and adjusted

costs are included in the Bid. Alternative equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.

.7 All additional costs for mechanical, electrical, structural and architectural revisions required to incorporate materials accepted as an equal and substituted by Contractor shall be responsibility of Contractor.

.8 Equipment listed as “equal” in specifications or submitted as equal by the Contractor must meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by the Contract Administrator. Install equipment in strict accordance with Manufacturer’s published recommendations.

1.7 EQUIPMENT IDENTIFICATION AND TAGGING

.1 Lamicoid nameplates are to be provided for all equipment as indicated on the drawings (e.g.: P-Z004, etc.) or as specified elsewhere within this specification. Lamicoids are to be 3 mm thick with white letters on a black background (except where required otherwise by any applicable codes). Letters shall be accurately aligned and machine engraved into the core. Minimum letter height shall be 6 mm and the plate shall be suitably sized for the text contained.

.2 All instrument and control (I&C) devices are to be numbered sequentially and simultaneously with all equipment.

.3 Valves are to be identified with the use of brass tags with 12 mm stamped code letters and numbers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store and handle materials in accordance with the manufacturer’s written directions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original unopened factory packaging, labelled with manufacturer's name, address, material, products included and location of installation.

.2 Storage Requirements:

.1 Store materials indoors in accordance with the manufacturer's recommendations for a clean, dry and well-ventilated area.

.2 All shipping crates and packaging too heavy to be moved by hand are to have adequate lifting eyes and/or attachments for handling.

.3 All packaging will be opened during receiving for inspection. If damage is discovered during receiving inspection, the Contractor shall be responsible for determining the extent of the damage and for arranging for the necessary replacement or on-site or remote repairs.

.4 All exposed machined metal surfaces have been sprayed with anti-corrosion spray. The Contractor shall be responsible for cleaning off all necessary protective coatings.

.5 All tanks, piping and the like are to be clean prior to shipping and shall be inspected upon delivery. If received with water and/or debris, the component(s) are to be cleaned appropriately.

.6 Desiccant bags are to be included in all crates. The size and number of desiccant bags is to be suitable for the size of the crate.

.7 All electrical components must be shipped in vacuum packaging.

.8 Store and protect equipment and materials in storage from nicks, scratches, and blemishes during and after installation and final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign materials into the working parts of piping and duct systems.

.3 Waste Management, Disposal and Cleanup:

.1 Remove tools, surplus and waste materials from the building site upon completion. Clean grease, dirt and excess materials from the walls, floors, ceiling and fixtures for which this Contract was responsible and leave the premise suitable for immediate use.

.2 Dispose of unused materials and waste at disposal sites approved by the Authority Having Jurisdiction.

.3 Dispose of unused paint and/or other hazardous materials at official hazardous materials collection sites approved by the Authority Having Jurisdiction. Do not dispose of unused paints or coating materials into the sewer system, into streams, lakes, onto the ground or in locations where it will pose health or environmental hazard.

1.9 GUARDING

.1 Provide all equipment guarding for all rotating shafts, gears, pinch points and the like for the equipment to protect personnel from accidental contact.

.2 Machine guards shall be designed to meet the requirements of the Manitoba Workplace Health and Safety Regulations.

.3 Drive guards shall be securely fastened but removable for servicing, constructed of expanded metal screen welded to steel frames with sufficient clearances to allow for equipment movement.

1.10 EXAMINATION OF THE SITE AND DOCUMENTATION

.1 Prior to submitting Bid, carefully examine site conditions, adjacent buildings and local conditions at the site, which could affect the work of this Division.

.2 Examine all contract drawings to ensure work can be performed without changes to the building, or work, as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences has been brought to the Contract Administrator's attention, in writing, prior to closing of Bids.

.3 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation thereof in locations shown on the drawings.

1.11 CONTRACT DRAWINGS AND SPECIFICATIONS

.1 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both. Many items, such as valves, vents, thermometers, pressure gauges, etc. are shown only on schematics and are not shown on

plan and elevation views. Provide and install all items shown in any or all of the drawings (or schematics).

.2 Should any discrepancy appear between the drawings and specifications, which leave the Contractor in doubt as to the true intent and meaning of the plans, and specifications, notify the Contract Administrator in accordance with B4. If this is not done it will be assumed that the most expensive alternative has been included in the Bid price. For any ruling to become binding, the Contract Administrator must issue the new direction in a published addendum.

.3 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.

.4 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and should not be used as an excuse for deficiencies or omissions.

.5 Follow the recommended installation details and procedures for equipment as found in Supplier technical data, supplemented by contract document details.

.6 Install piping, ductwork, etc., generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space. Remove piping, ductwork, etc. that is not properly installed and replace to the satisfaction of the City/Contract Administrator at no additional cost.

.7 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.

.8 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use of space through which they pass, while allowing adequate space for service, maintenance, repair, or replacement for all equipment.

.9 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. Basically, work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.

.10 All individual pieces of equipment shall be provided with appropriate means of isolation and bypass so that systems may continue to operate during maintenance of individual components. It is understood that this may not be possible in all situations, but this is a requirement where isolation is possible.

.11 Drawings and specifications to be considered as an integral part of contract documents and neither drawings nor specifications are to be used alone. Misinterpretation of

requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to the approval of the Contract Administrator.

.12 Obtain information involving accurate dimensions from dimensions shown by site measurement. Visit and inspect the site of the work to verify location and elevation of existing services which may affect the Bid and work of this Division (water, electrical, sanitary, ductwork etc.) before submission of Bid and proceeding with work. Make all necessary changes or additions to runs to accommodate structural conditions (pipes or ducts around beams, columns etc.) without additional expense to the City. Locations of pipes, ducts and other equipment to be altered without charge to City, provided change is made before installation and does not necessitate additional materials and that all such changes are acceptable to the Contract Administrator and are suitably recorded on Record Set of Drawings.

.13 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to existing Mechanical & Electrical components.

.14 As work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult the Contract Administrator for appropriate action before proceeding. This applies to all levels and proper grading of piping. If the Contractor fails to perform above checking and fails to inform the Contract Administrator of such interference, the Contractor to bear all subsequent expense to make good the installation.

1.12 SHOP DRAWINGS

.1 Submit to the Contract Administrator for review one electronic PDF set of detailed shop drawings.

.2 Check shop drawings for conformity to plans and specifications prior to submission.

.3 Submit shop drawings for all items specified in the sections of Divisions 22 and 23. For equipment, provide performance, physical and operating data as described in the Specifications and listed in equipment schedules. Provide performance curves for all pumps and fans.

.4 Shop drawings shall include copies of applicable brochure or catalogue material clearly indicating manufacturer and model. Ambiguous shop drawings will not be reviewed.

.5 Clearly mark submittal to indicate all differences from the specified material. The Contract Administrator will require all options and material indicated on the shop drawing to be provided and installed. Specifically note on the submittal specified features such as tank linings, pump seal materials, painting finish, etc.

.6 Include dimensional and technical data sufficient to determine if equipment meets requirements, including weights, loading points, electrical data and motor sizes.

.7 Identify the equipment by system name and number, e.g." S1, Second Floor, Air Supply Fan", "P1, Chilled Water Pump", etc.

.8 Installed materials and equipment shall meet specified requirements regardless of whether or not the shop drawings were reviewed by the Contract Administrator.

.9 Each drawing to include name of project, equipment supplier and clause number equipment is specified under.

.10 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.

.11 Take full responsibility for securing and verifying field dimensions. In cases 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 sub-trades are aware of these dimensions and shall comply with them.

.12 Review by the 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 the 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.

.13 The review by the Contract Administrator is for the sole purpose of ascertaining conformance with the design concept.

.14 Do not order equipment until the Contract Administrator has reviewed and returned the reviewed shop drawings.

.15 Keep one set of shop drawings on the site.

.16 Bind one complete set of checked shop drawings in each operating and maintenance instruction manual.

1.13 PERMITS, FEES AND INSPECTIONS

.1 Apply for, obtain, and pay for all permits, licences, inspections, examinations and fees required for work of Divisions 22 and 23.

.2 Review drawings with authorities having jurisdiction to ensure compliance with all applicable codes and by-laws.

.3 In case of conflict, codes and regulations take precedence over the contract documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein. Any discrepancies must be brought to the Contract Administrator's attention in writing.

.4 Before starting any work submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Contract Administrator immediately of such changes. Prepare and submit any additional drawings, details or information as may be required.

1.14 CUTTING AND PATCHING

.1 Cutting, core drilling, 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 to be included by Divisions 22 and 23 - Mechanical in Bid price.

Divisions 22 and 23 to employ and pay appropriate sub-trade whose work is involved, for carrying out work described above.

.2 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening, the opening size will be the minimum required, and that patching will be the responsibility of the trade making the opening to the original or specified conditions.

1.15 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and paint marred finished paintwork to match original.

.3 Restore to new condition finishes which have been damaged too excessively to be merely primed and touched up.

1.16 TEMPORARY USE OF EQUIPMENT

.1 Permanent systems and/or equipment not to be used during construction period, without the City's permission.

.2 Temporary use of equipment shall in no way relieve Contractor of providing warranties, as described elsewhere in this Section and in Division 1, on all equipment and systems so used.

.3 Operate systems under conditions that ensure no temporary or permanent damage. Operate systems with proper treatment. Operate fans at proper resistance with filters installed. Change filters at regular intervals and prior to final acceptance. Operate with proper safety devices and controls installed and fully operational.

.4 Under no circumstances shall air handling units be used to provide temporary heating or ventilation during construction. Air systems shall only be operated after any operation that creates considerable dust or fibres is complete.

1.17 OPERATING AND MAINTENANCE MANUALS (O&M)

.1 Provide O & M Manuals to the Contract Administrator for review 2 weeks prior to final inspection. Submission of individual data will not be accepted unless directed by the City of Winnipeg. Make changes and incorporate the Contract Administrator's review comments as required and re-submit as directed by the Contract Administrator.

.2 Provide three (3) sets of manuals in separate 3 "D" ring, loose leaf binders with spine and face pockets, with the project name clearly indicated on the spine and face. The D ring binders shall have index tabs, each containing the Subcontractors and suppliers names and telephone numbers, data sheets, valve charts, brochures, operating, maintenance and lubricating instructions as well as number coded wiring diagrams and a complete set of reviewed shop drawings for all equipment provided by this Division.

.3 The final accepted copies shall be provided to the City.

.4 General catalog data for the Operations and Maintenance Manual is unacceptable. If manufacturer's specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g., PRV-1) is to be noted on Manufacturer's specification sheet which

includes all details for this unit, including complete model number, serial number, and construction & performance data.

.5 The outline for the Operating & Maintenance Manual shall be as follows:

- Introduction
- Purpose
- General Description
- Operating Instructions
- Seasonal Operations
- Normal Valve Positions and Control
- Recommended Inspection and Preventative Maintenance
- Maintenance Schedule
- Description of Maintenance Procedures
- Recommended Major Equipment Spare Parts List
- Estimated Annual O & M Costs (hours and equipment)
- Suggested Maintenance Record Form
- Appendices
  - Equipment Shop Drawings
- Safety Practices
- Equipment Supplier Schedule
- Manufacturer Recommended O & M Information
- Exploded Views and Parts Lists
- As-Built Drawings (reduced)
- Control Narrative

.6 Include the following information in the manuals, incorporated into the outline format above, as applicable:

.1 Mechanical Systems

.1 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their respective controls including sequences of operation.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.2 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Manufacturer’s preventative maintenance procedures.

.3 Data to include schedules of tasks, frequency, tools required and task time including daily, weekly, monthly, semi-annual and annual checks.

.3 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.4 Lubrication Information.

.5 List of Contractors and Equipment Suppliers including contact information.

.6 Parts and Troubleshooting Information.

.2 Certification and Identification

.1 Inspection Certificates

.2 Balance Reports

.3 Component Information

.1 One section for each type of equipment to include shop drawings and installation and maintenance information.

.4 Safety Information

.5 Additional Information

.1 Prepare and insert into Operation & Maintenance Manual additional data when need for it becomes apparent during specified demonstrations and instructions.

1.18 COMMISSIONING

.1 Pre-commissioning Requirements:

.1 The supplier and/or installation Contractor are to prepare pre-commissioning procedures and additional information as required for inclusion in the Project Commissioning Plan and final documentation. The required information is to be submitted to the City and Contract Administrator for review and approval prior to commissioning of the system. Furthermore, the Contractor is to confirm in writing that they have adequate provisions for Testing, Adjusting and Balancing (TAB) and other aspects of the design and installation pertinent to the success of TAB. During construction, the supplier and/or installation Contractor is to coordinate the location and installation of TAB devices, equipment, accessories, measurement ports and fittings with the City and the Contract Administrator. TAB personnel shall provide a pre-commissioning instrument setpoint list.

.2 Shop Testing Requirements:

.1 The Contract Administrator may appoint an inspector to provide inspection, quality assurance and testing supervision pertaining to the work being performed at the Contractor’s facility and those of its Subcontractors.

.2 Such tests shall be performed at the expense of the Contractor and shall be in accordance with the appropriate ASME, CSA, ASTM or other applicable standard(s).

.3 All pressure equipment shall be hydrostatically tested in accordance with the Codes, Standards and this Technical Specification.

.4 Prior to leaving the Contractor's facility, the equipment shall be tested under load and operational tests shall be performed on all electrical and mechanical components to demonstrate that the equipment meets the requirements of this specification. All pressure relief valves are to be set in the shop.

.5 The Contractor shall also perform the following factory tests on the equipment electrical systems:

.1 Factory electrical wiring continuity and insulation tests.

.2 Motor insulation tests.

.3 Motor running current under no load and full load are within acceptable ranges.

.3 Field Testing and Commissioning Requirements:

.1 Systems commissioning will be conducted prior to substantial completion. The purpose of the Commissioning is to ensure all systems are functioning as designed prior to substantial completion.

.2 The supplier and/or installation Contractor are to provide all of the necessary equipment for conducting the required field tests. Again, the supplier and/or installation contractor are to prepare commissioning procedures and additional information as required for inclusion in the Project Commissioning Plan and the final documentation.

.3 The site tests, at a minimum, shall prove the following:

.1 Static Tests – Static pressure tests and valve leak tests.

.2 Running Tests – After installation but before being placed into service, the equipment shall be powered and tested to prove the following:

.1 All clearances and alignments are in order.

.2 Lubrication (if applicable) is adequate.

.3 Operation of each controller, relay, limit switch and all other control device is satisfactory and operates correctly.

.4 All circuits, controls and interlocks sequence of operation is correct.

.5 All protective and indicating devices operate satisfactory.

.4 Testing, Adjusting and Balancing (TAB) shall be performed in accordance with the requirements of the Associated Air Balance Council (AABC). The recommendations and suggested practices contained in the TAB standard shall be considered mandatory.

.5 Use the TAB standard provisions, including checklists and report forms to satisfy the Contract requirements.

.6 Firm and personnel performing TAB shall be qualified in accordance with the TAB standard.

.4 Commissioning will require the presence of knowledgeable representatives of the necessary Mechanical Trades. The Mechanical Contractor shall include all necessary costs for systems commissioning. The Contract Administrator will participate to the extent deemed necessary.

.5 All HVAC control system testing is to be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Contract Administrator is notified of the system demonstration.

.6 All control wiring shall be verified for proper connections, free of all shorts, ground faults and that the terminations are tight. All input devices shall be calibrated individually with the calibration procedures recommended by the manufacturer.

.7 Verify that all binary output devices operate properly and that the normal positions are correct. The installation contractor must also verify that all analog output devices are functional, that start and span are correct and that the direction and normal positions are correct.

.8 All aspects of mechanical systems operations will be operated, checked and verified. If any portion of the work fails to meet design requirements, the Commissioning procedure will be halted and only resumed when all necessary repairs are completed. All extra costs including costs for the Contract Administrator to revisit the site resulting from this postponement will be borne by the Contractor.

.9 Verify that the system operation adheres to the sequence of operation. All modes of operation shall be simulated and observed by overriding and varying inputs and schedules.

.10 Submit, to the Contract Administrator, a commissioning report detailing the commissioning tests performed and the results of these tests. Format of report is to be one sheet for each piece of mechanical equipment and it shall include: Equipment tag, Description, Location and point form description of tests and results.

1.19 SUBSTANTIAL COMPLETION

.1 Prior to requesting any substantial completion inspection, complete all of the following items:

.1 All systems shall be operational with alarms, interlocks and control functions.

.2 Obtain all certificates of approval from the authorities having jurisdiction.

.3 All manufacturer start-ups shall be complete.

.4 Complete valve tagging and identification of all new mechanical systems and components.

.5 Lubricate all equipment as per manufacturers' instructions.

.6 Submit required documentation and perform operator training.

.7 Provide all Manufacturers' reports required by the specifications.

.8 Complete all previously identified deficiencies.

.9 Clean equipment both inside and out.

.10 Complete final air and water balancing and submit reports.

.11 Complete final calibration.

.12 Provide As-Built record drawings in accordance with the Bid documents.

.2 After the completion of tests and adjustments, remove temporary covers, strainers and/or obstructions to flow. Drain, flush and refill piping systems as often as required until all piping is clear of dirt and debris.

.3 Leave all mechanical Works in their specified working order.

.4 Provide spare components as specific in this and other Sections of Divisions 22 and 23.

.5 Provide one set of all specialized tools required to service the equipment as recommended by the manufacturers.

1.20 DOCUMENTATION AND SYSTEMS ACCEPTANCE

.1 Provide the following on substantial completion of the work:

.1 Operation & Maintenance Manuals as called for elsewhere in this Section.

.2 Site records (Record Drawings):

.1 The Contract Administrator will provide [1] set of reproducible mechanical drawings as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducible drawings, revising the reproducible drawings to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.3 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to the Contract Administrator for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing using the as-built drawings.

.5 Submit completed reproducible as-built drawings with the Operating & Maintenance Manuals.

.4 Submit copies of as-built drawings for inclusion in final TAB report.

.5 Extended warranty certificates where specified in other Sections of Divisions 22 and 23.

.6 Air balancing report. The work of Divisions 22 and 23 will not be considered totally performed until acceptance by the Contract Administrator of the Air Balancing Report.

1.21 GUARANTEES AND WARRANTEES

.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 time as define in Division 1, but in no circumstances shall the warranty period be less

than one (1) year after final acceptance of complete contract by the City. Make good all damage 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 City, all such defective work or materials and consequence resulting, within the period of time defined in Division 1, but not less than one (1) year from time 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.

.4 Comply with requirements of Division One. Where warranties specified in Division 1 are longer, or more stringent than in Divisions 22 and 23, Division 1 shall govern. Provide warranties on specified products, equipment and components as well as on the installation of these items. Include for all costs for cutting and patching, removals and restoration materials and work and repairs to other equipment affected in performance of warranty work.

.5 Provide warranty certificates, wherever given or required, that are in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and system.

1.22 SPECIAL TOOLS AND SPARE PARTS

.1 Furnish the City with spare parts as follows:

.1 Spare parts as detailed in the individual Sections of Division 22 and 23.

.2 One set of fan belts in addition to the final operating set.

.3 One filter cartridge or set of filter media for each filter or filter bank in addition to the final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings (if applicable).

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.2 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum the interior of the ductwork.

3.3 DEMONSTRATION

.1 The Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 The Contract Administrator will record these demonstrations on video tape for future reference.

3.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 This Sections details the methods and guidelines for the installation of piping.

Part 2 Products

2.1 Effluent Pipe

.1 Piping

.1 304 stainless steel piping, sch. 10S, ERW, ASTM A312 Gr. TP304

.2 Flanges

.1 Forged S.S. weld-neck or slip-on, ASTM A182 Gr. F-304, ANSI B16.5 Class 150.

.3 Bolting

.1 BOLTS: S.S. ASTM A307 Gr.B, ANSI B18.2.1 Semi-finished Heavy Hex. Head, ANSI B1.1 UNC Class 2A Thread.

.2 NUTS: S.S. ASTM A563 Gr.A, ANSI B18.2.2 Semi-finished Heavy Hex., ANSI B1.1 UNC Class 2B Thread.

.4 Gaskets

.1 Compressed non-asbestos, 1.6mm (1/16”) thickness.

Part 3 Execution

3.1 Effluent Piping

.1 Use ASTM A312 Gr. TP304L butt welded, material, including for pipe supports.

.2 All welding shall be done by qualified welders, under CSA Specification W47 in accordance with the requirements of CSA W59.

.3 The following processes are approved for pipe fabrication, assembly and erection:

.1 Gas Tungsten Arc (GTAW) – manual or automatic welding, inert gas shielding.

.2 Gas Metal Arc (GMAW) – semi-automatic welding, inert gas shielding

.3 Plasma Arc (PAW) – automatic welding only for thickness above 3/8”, neutral (non-alloying) flux shielding.

.4 Submerged Arc (SAW) – automatic welding only for thickness above 3/8”, neutral (non-alloying) flux shielding.

Inert gas shielding shall consist of Argon, Helium or a mixture of these two. Mixtures or Argon and / or Helium with not more than 5% by volume of H2, O2 and/or CO2 shall be used only with Contract Administrator's prior approval.

3.2 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions and datasheets.

3.3 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

3.4 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment and components.

3.5 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may not be used.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.

.8 Slope piping, except where indicated, in the direction of flow for positive drainage and venting.

.9 Group piping wherever possible. Group piping runs at common elevations.

.10 Ream pipes, remove scale and other foreign material before assembly.

.11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.12 Provide for thermal expansion as indicated and specified.

.13 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

3.6 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Contract Administrator 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Divisions 22 and 23.

.3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer periods of time in relevant sections of Division 22 and 23.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in the presence of the Contract Administrator.

.6 Pay costs for repairs or replacement, retesting, and making good. Contract Administrator to determine whether a repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Contract Administrator.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Supply of materials and installation for pressure gauges in piping systems where shown on the drawings.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B40.100, Pressure Gauges and Gauge Attachments.

.2 ANSI/ASME B40.1, Gauges-Pressure, Indicating Dial Type-Elastic Element.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 230500.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

2.2 PRESSURE GAUGES

.1 2 ½", dial type, liquid filled, stainless steel having 1.6% accuracy, ¼" NPT connection, 0 – 10 PSI range.

.2 Acceptable Product: Winters, Ashcroft, Kodiak or approved equivalent.

.3 Provide:

.1 Isolation ball valve on all pressure gauge connections.

.2 No petcocks.

Part 3 Execution

3.1 GENERAL

.1 Install gauges so they can be easily read from the floor.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 The Contractor is to design, select, supply and install HVAC and piping support systems suitable for the applications indicated.

.2 Provide accommodation for pipe expansion where required.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1, Power Piping.

.2 ASME B31.9, Building Services Piping

.2 ASTM International

.1 ASTM A125-[1996(2007)], Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-[07b], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-[07a], Standard Specification for Carbon and Alloy Steel Nuts.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-[2002], Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-[2003], Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-[2003], Pipe Hangers and Supports - Fabrication and Installation Practices.

.4 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba.

.2 Submit shop drawings and product data for the following items:

.1 Bases, hangers and supports for HVAC and piping.

.2 Connections to equipment and structures.

.3 Structural assemblies.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hangers and supports to the manufacturer’s recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into HVAC ductwork or piping or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use electro-plating galvanizing process.

.2 Attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless (forged) steel eye nut. Ensure eye [6] mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP69.

.3 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.4 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Oversize pipe hangers and supports.

2.4 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125.

.2 Load adjustability: [10]% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.5 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade stainless steel.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.7 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads [50] mm larger than equipment; chamfer pad edges.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of the Canadian Plumbing Code or the authority having jurisdiction.

.2 Within [300] mm of each elbow.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Materials and requirements for the identification of piping systems, ductwork, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

1.3 SUBMITTALS

.1 Product data to include paint colour chips, other products specified in this section.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate: mechanically fastened to each piece of equipment by the manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Provide nameplates for all equipment designated by Tags as indicated in the drawings. e.g. PU-1, EF-2.

.2 Colours:

.1 Black letters, white background (except where required otherwise by applicable codes).

.3 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, square corners, letters accurately aligned and machine engraved into core.

.4 Sizes:

.1 Conform to following table:

Type	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.5 Locations:

.1 Terminal cabinets, control panels: use Type 5.

.2 Equipment in Mechanical Rooms: use Type 8.

.3 Equipment elsewhere: sizes as appropriate.

2.3 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows in accordance with CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

Acceptable Material: W.H. Brady, Seton Name Plate Corporation, Setmark Pipe Markers.

IDENTIFICATION DUCTWORK SYSTEMS

.7 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.8 Colours: black, or co-ordinated with base colour to ensure strong contrast.

.9 Identify ducts using the following labels (at least once in each room): Supply, Relief.

2.4 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

2.5 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

.2 Provide identification only after the completion of painting.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Perform pipe identification as piping is installed and insulated.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Protection:

.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas at not more than 10 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 At least once in each small room through which piping or ductwork passes.

.3 At beginning and end points of each run and at each piece of equipment in run.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures where in plain sight of the equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to the Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications and successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to the Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to the Contract Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by the Contract Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify the Contract Administrator 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weatherstripping, sealing, and caulking.

.3 Provisions for TAB installed and operational.

.4 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10 %, minus 5 %.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to the Contract Administrator the list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration the Contract Administrator.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 TAB REPORT

.1 Format in accordance with AABC.

.2 TAB report to show results in SI units and is to include system schematics.

.3 Submit 1 copy of the TAB Report to the Contract Administrator for verification and approval, in English in a D-ring binder, complete with index tabs.

1.15 SETTINGS

.1 After TAB is completed to satisfaction of the Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during the life of the facility. Do not eradicate or cover markings.

1.16 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by the Contract Administrator.

1.17 AIR SYSTEMS

.1 Standard: TAB to most stringent of TAB standards of AABC or ASHRAE.

.2 Do TAB of the following systems, equipment, components and controls including all grilles, dampers and zone pressurization specified in Division 23:

.1 Supply fan SF-Z603.

.2 Flow through all grilles as shown on the drawings.

.3 For the above mentioned equipment, set airflow to values shown on the drawings.

.4 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filters, fans or other equipment.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include main ducts, branches grilles, registers or diffusers.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Provide and install all duct insulation and jacketing.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C411-97, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.3 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-[03], Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Provide manufacturer’s printed literature and data sheets for duct insulation, hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide manufacturer’s catalogue literature for approval related to the installation sequence, fabrication and special handling criteria for the duct jointing recommendations.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified, includes glass fibre, rock wool, slag wool or approved equivalent.

.2 Thermal conductivity ("K" factor) not to exceed specified values at 24^{o}C mean temperature when tested in accordance with ASTM C335.

.3 Round and rectangular duct insulation type and thickness:

.1 Vapour Retarder: C-1

.2 Thickness (mm): 50

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma for round and rectangular ducts.

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "K" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas, 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921 or approved equivalent for round or rectangular ducts.

.2 Lagging adhesive: Compatible with insulation.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Surfaces clean, dry and free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and as indicated.

.3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.4 Hangers and supports in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.5 Fasteners: At 300 mm o.c. in horizontal and vertical directions, minimum two rows each side.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International

.1 ASTM A653/A653M-[11], Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-[12], Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-[12], Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, [2005].

.2 SMACNA HVAC Air Duct Leakage Test Manual, [2012].

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Maximum Pressure (Pa): 500

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with duct sealant. Longitudinal seams unsealed.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

.1 Acceptable Material: Duro Dyne S-2.

2.3 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.4 FITTINGS

.1 Radiused elbows:

.1 Rectangular: standard radius or short radius without turning vanes. Centerline radius: 1.5 times width of duct.

.2 Round: smooth radius. Centreline radius: 1.5 times diameter.

.2 Branches:

.1 Rectangular main and branch: with radius on branch, 1.5 times width of duct.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.3 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.4 Offsets:

.1 Full radiused elbows.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

2.6 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hangers: galvanized steel angle with galvanized steel rods.

.3 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 Relief discharges.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder or weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards louvers served.

3.4 SEALING AND TAPING

.1 Apply sealant to the outside of joints to manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation for duct accessories including flexible connections.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Mechanical HVAC General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Instrument test ports.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of [1.3] kg/m^2.

Part 3 Execution

3.1 MANUFACTURER’S INSTUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 As indicated on drawings.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Balancing dampers for mechanical forced air ventilation systems.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 Execution

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated on the drawings in accordance with the recommendations of SMACNA and in accordance with the manufacturer's instructions.

.2 Locate vibration free balancing dampers in each branch duct. Runouts to registers and diffusers are single blade dampers located as close as possible to the main duct.

.3 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Modulating dampers for mechanical forced air ventilation systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM A653/A653M-[04a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Parallel blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Extruded aluminum (6063-T5) damper frame shall not be less than 2 mm in thickness. Damper frame shall be 100 mm deep x 25 mm with duct mounted flanges on both sides of frame. Frame to be assembled using zinc-plated steel mounting flanges. Welded frames shall not be acceptable.

.4 Blades shall be extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.5 mm. Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken.

.5 Maximum blade height: 163 mm.

.6 Blade seals shall be extruded EPDM, secured in an integral slot with the aluminum blade extrusion and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.

.7 Frame seals shall be extruded silicone, secured in an integral slot with the aluminum blade extrusion and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.8 Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 11.11 mm aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted into the frame. Single axle bearings, rotating in an extruded or punched hole will not be approved.

.9 Hexagonal control shaft shall be 11.11 mm. It shall have adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.

.10 Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage. Linkages that consist of metal rubbing metal will not be approved.

.11 Dampers shall be designed for operation in temperatures ranging from minus 40 degrees C to plus 100 degrees C.

.12 Dampers shall be AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under AMCA Certified Ratings Program.

.13 Dampers shall be installed in the following manner: Flanged to duct.

.14 Installation of dampers must be in accordance with Tamco's current installation guidelines, provided with each damper shipment.

.15 Acceptable Product: Tamco Series 9000 Thermally Insulated Damper, as manufactured by T.A. Morrision & Co., Inc or approved equivalent.

2.3 ACTUATION

.1 On/off spring return damper actuators shall be direct coupled type which require no crank arm or linkage and be capable of direct mounting to a jackshaft in either clockwise or counter clockwise fail-safe operation.

.2 Actuator to be protected from overload at all angles of rotation.

.3 Actuators shall be UL or ULc listed and have a 5 year warranty and be manufactured under ISO 9001 International Quality Control Standards.

.4 Acceptable Product: Belimo NFBUP-S N4 (120 VAC) – Damper Actuator or approved equivalent.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated on drawings in accordance with the recommendations of SMACNA and in accordance with the manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply, installation, testing and commissioning of a supply fan.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99-2003, Standards Handbook.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Underwriters Laboratories (UL):

.1 705 – Standard Power Ventilators

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.3 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Mechanical HVAC General Provisions. Include product characteristics, performance criteria, and limitations.

.2 Provide:

.1 Fan performance curves showing point of operation with the flow, static pressure and horsepower clearly plotted.

.2 Provide manufacturer’s certification that the fans are licensed to bear Air Movement and Control Associations (AMCA), Certified Rating Seal for sound and air performance.

.3 Installation, Operation and Maintenance (IOM): Provide manufacturer’s IO&M manual, including instructions on installation, operations, maintenance, pulley

adjustment, receiving, handling, storage, safety information and cleaning. Include troubleshooting guides, parts lists, warranty and electrical wiring diagrams.

Part 2 Products

2.1 GENERAL

.1 Motors:

.1 High efficiency motors are to be provided.

.2 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 CENTRIFUGAL FANS

SF-Z603 Effluent Monitoring Station Supply Fan

.1 Belt driven backward inclined centrifugal inline supply fan with non-overloading aluminum wheel.

.2 Statically and dynamically balanced in accordance with AMCA Standard 204-05.

.3 Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

.4 Motor:

.1 Motor enclosure: TEFC

.2 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase. 115V, 60 Hz, 1 phase. ¼ HP.

.3 Performance: 240 L/s (510 cfm) at 150 Pa (0.6" w.c.). BHP at rated condition to be 0.18 HP max. Max sones: 10.5.

.5 Shafts and Bearings:

.1 Fan shaft shall be ground and polished solid steel with an anti-corrosive coating.

.2 Fan shaft mounted in ball bearing pillow blocks.

.6 Housing/Cabinet Construction:

.1 Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars.

.2 Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

.7 Housing Supports and Drive Frame:

.1 Housing supports are constructed of structural steel with formed flanges.

.2 Drive frame is welded steel which supports the shaft and bearings and reinforcement for the housing.

.3 Pivoting motor plate with adjusting screws to make belt tensioning operations.

.8 Disconnect Switches:

.1 NEMA 12 rated.

.2 Positive electrical shut-off.

.3 Wired from fan motor to junction box installed within motor compartment.

.9 Drive Assembly:

.1 Belts, pulleys and keys oversized for a minimum of 150% of the driven horsepower.

.2 Belts: Static free and oil resistant.

.3 Pulleys: Cast type, keyed and securely attached to wheel and motor shafts.

.4 Motor pulleys are adjustable for final system balance.

.5 Readily accessible for maintenance.

.10 Access Panel:

.1 Two sided access panels to permit easy access to all internal components.

.2 Located perpendicular to the motor mounting panel.

.11 Belts:

.1 Standard static free belts.

.12 Insulated Housing:

.1 Thickness: 25 mm (1”) for noise control constructed of a fibreglass liner.

.13 Isolation:

.1 Type: Spring hanging sized to match the weight of the fan assembly.

.14 Motor Cover:

.1 Constructed of galvanized steel to cover the motor and the drive.

.15 Acceptable product: Greenheck Model BSQ-90-4 Belt Drive Centrifugal Inline Fan or approved equivalent.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fan in accordance with the manufacturer’s instructions.

.2 Ensure that fan housing does not touch rigid duct while in operation.

.3 Ensure no unusual vibration or noise is present.

.4 Use vibration isolation as specified above.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Supply and relief grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Mechanical HVAC General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level and neck velocity.

.2 Frames:

.1 Full perimeter gaskets.

.3 Colour: standard.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY REGISTERS

.1 General: Louvered Steel Supply Register – 19 mm (¾”) Blade Spacing, Double Deflection.

.2 Register shall be double deflection type with two sets of fully adjustable deflection blades 19 mm (3/4”) on center.

.3 Size: 300 mm x 300 mm (12” x 12”).

.4 The damper shall be operable from the register face.

.5 The damper shall be coated steel.

.6 The grille shall be finished in B12 - White Powder Coat.

.7 Fastening: Countersunk screw holes with screws.

.8 Acceptable Product: Price 520D Louvered Steel Supply Register or approved equivalent.

2.4 RETURN GRILLES

.1 General: Louvered Steel Return Grille – 19 mm (¾") Blade Spacing, 45° Single Deflection.

.2 Grilles shall be 45 degree deflection fixed louver type with blades spaced 19 mm (¾") on center.

.3 Size: 300 mm x 300 mm (12" x 12").

.4 The damper shall be coated steel.

.5 The grille shall be finished in B12 - White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measureable creep in accordance with ASTM D1654

.6 Fastening: Countersunk screw holes with screws.

.7 Acceptable Product: Price 530 Louvered Steel Return Grille or approved equivalent.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with stainless steel screws in countersunk holes where fastenings are visible.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Mechanical louvers, intakes and vents.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Mechanical HVAC General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 FIXED VERTICAL LOUVRES - ALUMINUM

.1 Application: All wall louvres mounted in in the vertical position (for horizontal airflow).

.2 Construction: welded with exposed joints ground flush and smooth.

.3 Performance rated in accordance with AMCA Standard 500.

.4 Material: extruded aluminum alloy 6063-T5. 39° blade angle.

.5 Louvre depth: 100 mm.

.6 Drainable blade with vertical jamb gutter and 125 mm (5”) blade spacing.

.7 Minimum free area: 53.6% based on a 1220 mm x 1220 mm louvre.

.8 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 2 mm thick with approved caulking slot, integral to unit.

.9 Design wind load: 161 kph (100 mph).

.10 Screen: 12 mm x 12 mm (½” x ½”) 16 gauge expanded aluminum bird screen without frame.

.11 Free area velocity at the beginning point of water penetration is to be at least 270 m/min (886 FPM) as defined by AMCA Standard 511. Pressure drop at beginning of water penetration to be 3 Pa (0.13" w.c.) or less.

.12 Finish: factory applied enamel, prime coated and anodized. Colour: to match adjacent cladding, refer to architectural.

.13 Acceptable Product: Price DE439 Fixed Blade Louvre or approved equivalent.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Mechanical filtration for supply fan.

1.2 REFERENCES

.1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE 52.2-[12], Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10-[M90], Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Mechanical HVAC General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for HVAC filters and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40°C and 50°C.

2.2 ACCESSORIES

.1 Holding frames: permanent channel section construction of the same material as casing/hood, 1.6 mm thick, except where specified.

.2 Seals: to ensure leakproof operation.

.3 Access and servicing: through doors/panels on each side.

2.3 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: galvanized steel, or slide in channel for side access.

.3 Performance:

.1 Average atmospheric dust spot efficiency 30-35%.

.2 Average synthetic dust weight arrestance 90%.

.4 Fire Rated: to ULC -S111.

.5 Nominal thickness: 50 mm.

.6 Size: 350 mm (14”) wide x 625 mm (25”) long x 50 mm (2”) height

Part 3 Execution

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION GENERAL

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.3 REPLACEMENT MEDIA

.1 Replace media with new upon acceptance.

.2 Filter media new and clean, as indicated by pressure gauge, at time of acceptance.

.3 Provide 3 sets of spare filters.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Inline SCR controlled duct heater for mechanical forced air ventilation systems.

1.2 REFERENCES

.1 CSA Group

.1 CSA C22.2 No.46-13, Electric Air-Heaters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Mechanical HVAC General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for duct heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit product data and include:

.1 Element support details.

.2 Heater: total kW rating, voltage, phase.

.3 Number of stages.

.4 Rating of stage: rating, voltage, phase.

.5 Heater element watt/density and maximum sheath temperature.

.6 Maximum discharge temperature.

.7 Unit support.

.8 Clearance from combustible materials.

.9 Internal components wiring diagrams.

.10 Minimum operating airflow.

.11 Pressure drop minimum airflow.

Part 2 Products

2.1 DUCT HEATERS

.1 Duct heaters: insert type.

.2 Elements:

.1 Helical coils of nickel chrome alloy resistance wire.

.3 Staging:

.1 One staged heater: balanced line current.

.4 Maximum temperature at discharge: 93°C (200°F).

.5 Controls:

.1 Factory mounted and wired in control box. Use terminal blocks for power and control wiring to thermostat and sail switch.

.2 Controls mounted in a CSA Type NEMA 4 enclosure and to include:

.1 SCR Step controller.

.3 Where controls are mounted in heater, exercise care in mounting contactors to minimize switching noise transmission through ductwork.

.4 High temperature cutout and air proving switch.

.6 Electrical:

.1 Duct heater rating:

.1 16 kW.

.2 208 voltage.

.3 3 phase.

.7 Acceptable Product: Price-Neptronic DF CI00H Duct Heater or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Make power and control connections to CSA C22.2 No.46.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in presence of the Contract Administrator.

.1 Provide test report and include copy with Operations and Maintenance Manuals.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Install electric unit heaters (UH-Z606, UH-Z607) on the main floor of the new Effluent Monitoring Station.

.2 Install electric baseboard unit heater (UH-Z608) in the dry well of the new Effluent Monitoring Station.

.3 Test and commission the unit heaters.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.46-[M1988(R2006)], Electric Air-Heaters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-[08], Enclosures for Electrical Equipment (1000 V Maximum).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Mechanical HVAC General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit product data sheets for unit heaters. Include:

.1 Product characteristics.

.2 Performance criteria.

.3 Mounting methods.

.4 Physical size.

.5 kW rating, voltage, phase.

.6 Motor information (including enclosure type and design temperature rise).

.7 Cabinet material thickness.

.8 Limitations.

.9 Colour and finish.

.3 Shop Drawings:

.1 Indicated:

.1 Equipment, capacity and piping connections (if applicable).

.2 Dimensions, internal and external construction details, recommended method of installation with proposed (structural steel) support, size and location of mounting bolt holes.

Part 2 Products

2.1 UNIT HEATERS (UH-Z606, UH-Z607)

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet.

.2 Fan type unit heaters with high-limit temperature control with automatic reset protection and fan-delay switch.

.3 Fan motor:

.1 1/30 HP, 208V, 3 phase, 1550 rpm totally enclosed type with factory-lubricated ball bearing motor.

.2 Built-in fan motor thermal overload protection.

.4 Hangers: use supplied wall mounting brackets.

.5 Elements: stainless steel tubular heating elements.

.6 Cabinet: 18 and 20 gauge steel, fitted with wall brackets for wall mounting.

.1 Standard epoxy/polyester powder paint in almond colour.

.7 Performance: 236 L/s (500 cfm), 4.0 kW (13,648 Btu/h)

.8 Acceptable Product: Ouellet OAS04038 with OAS-T Thermostat or approved equivalent.

2.2 UNIT HEATERS (UH-Z608)

.1 Baseboard unit heater: to CSA C22.2 No.46.

.2 Standard electric baseboard heater with linear high-limit temperature control with automatic reset protection.

.3 Heating element:

.1 120V, 1 phase.

.4 Hangers: use wall mounting brackets.

.5 Elements: stainless steel tubular heating element with aluminum fins.

.6 Cabinet: 20 gauge steel for wall mounting.

.1 Standard epoxy/polyester powder paint in white colour.

.7 Acceptable Product: Ouellet OFM0502 with OFM-TB6-AV Thermostat or approved equivalent.

2.3 CONTROLS

.1 Built in thermostat and support controls.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with the manufacturer’s instructions.

.2 Mount unit heaters on the wall as indicated.

.3 Adjust built-in thermostats to maintain the Effluent Monitoring Station inside temperature at 10°C.

.4 Make power and control connections.

.5 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.2 FIELD QUALITY CONTROL

.1 Test cut-out protection when air movement is obstructed.

.2 Test fan delay switch to assure dissipation of heat after element shut down.

.3 Test unit cut-off when fan motor overload protection has operated.

.4 Ensure heaters and controls operate correctly.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION