



Smith + Andersen

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MECHANICAL SPECIFICATION

FOR

GOLDRING STUDENT CENTER

150 CHARLES ST. W., TORONTO, ON

THIS SPECIFICATION SHALL BE READ IN CONJUNCTION WITH DRAWINGS:

REFER TO DRAWING TM-0.1 FOR DRAWING LIST

OUR PROJECT NUMBER:

23501.003.M.001

DATE:

2024-02-02

ISSUED FOR:

TENDER

20.00.00.00
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END OF SECTION

20 05 00.00
General Instructions for Mechanical Sections

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.
- 1.1.2. The Specification is divided into Sections which are not intended to identify contractual limits between Subcontractors nor between the Contractor and their Subcontractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.
- 1.1.3. Provide mechanical components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

1.2. INTENT

- 1.2.1. Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.
- 1.2.2. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
- 1.2.3. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and part of equipment and repair related damages.

1.3. SECTIONS AFFECTED

- 1.3.1. These instructions apply to and form a part of all Division 20, 21, 22, and 23 Sections referred herein as Mechanical.

1.4. REGULATIONS

- 1.4.1. Work shall be performed in accordance with codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
- 1.4.2. The plumbing and drainage systems shall comply with regulations respecting plumbing made under the following legislation except as modified by rules, regulations and by-laws of authorities having jurisdiction:
 - .1 Ontario Water Resources Act.
 - .2 Ontario Plumbing Code.
- 1.4.3. These Specifications are supplementary to the requirements above.
- 1.4.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the Contractor shall notify the Engineer's Representative.

1.5. PERMITS, FEES INSPECTION

- 1.5.1. Obtain all permits, make submissions, pay all fees and arrange for all inspections required for the work of this Division.

1.6. EXAMINATION OF SITE

- 1.6.1. Before submitting Bids, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.7. DRAWINGS, CHANGES AND INSTALLATION

- 1.7.1. The Drawings shall be considered to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operational installation.
- 1.7.2. The location, arrangement and connection of equipment and material as shown on the Drawings represents a close approximation to the intent and requirements of the work. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no additional cost.
- 1.7.3. In order to show more clearly the arrangement of the work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standard Details and to the Specifications to determine the requirements.
- 1.7.4. Equipment installed by this Division shall installed in accordance with the manufacturer's installation requirements. In the event of conflicts between the Drawings or Specifications and the manufacturer's installation requirements, the Contractor shall notify the Engineer's Representative.
- 1.7.5. Certain Details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence.
- 1.7.6. All piping and ductwork in finished areas shall be concealed in ceiling spaces and shafts or furred into walls. No exposed piping or ductwork shall be installed in such areas unless specifically reviewed and accepted by the Engineer's Representative. No piping shall be concealed in outside walls.
- 1.7.7. The location and size of existing services shown on the Drawings are based on the best available information. The Contractor shall site verify the actual location of existing services before work is commenced. Particular attention shall be paid to buried services.
- 1.7.8. Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other Trades, or to accommodate existing conditions, shall be made at no additional cost.
- 1.7.9. Leave areas clear of piping and ducts where space is indicated as reserved for future equipment and equipment for other Trades.
- 1.7.10. Adequate space and provisions shall be left for removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.7.11. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.

- 1.7.12. Before fabricating ductwork or piping for installation, make certain that such items can be installed as shown on the Drawings without interfering with the structure or the work of other Trades. Any problems that cannot be solved in agreement with the other Trades affected, shall be submitted for decision. If ductwork or piping is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at no additional cost.
 - 1.7.13. Location of diffusers, grilles registers, thermostats, sprinklers and all other equipment shown on plans is diagrammatic. Layout of each device in finished areas is critical in terms of symmetry and location. Refer to Architectural Drawings and to site instructions in all regards. Any work not installed in the correct location (at the sole discretion of the Engineer's Representative) shall be remedied by this Contractor at their expense. This Contractor is responsible for mark-out of their work, fully co-ordinated with all other trades, in sufficient time for review by Engineer's Representative prior to rough-in. All mechanical and sprinkler services shall be located precisely.
- 1.8. MATERIALS
- 1.8.1. Make and quality of materials used in the construction of this work shall be subject to the approval of the Engineer's Representative.
 - 1.8.2. Materials and equipment supplied by this Division shall be new and free from defects and shall be as specified by the manufacturer's name and catalogue reference.
 - 1.8.3. Where a manufacturer's equipment has been specified by name and/or model number, the Contractor shall be responsible to ensure that the performance and quality of equipment provided by an acceptable manufacturer, meets the specified equipment performance, is inclusive of all standard and specified optional features, and can be installed in the planned location with access and maintenance clearances in accordance with the manufacturer's recommended installation. This Contractor shall also confirm all required piping, duct and electrical connections are provided at no additional cost.
- 1.9. CO-OPERATION WITH ENGINEER'S REPRESENTATIVE
- 1.9.1. To assist in the successful execution of the project, the Contractor will receive an initial job report that summarizes the expectations of the Engineer's Representative and the Contractor. This job report covers topics such as progress billings, shop drawing requirements, change order pricing, the commissioning process, installation drawings, the Specifications, as-built drawings and operations and maintenance manuals, along with a number of other items. This job report is intended to reiterate key items from the Contract Documents and is not intended to impose new requirements.

- 1.9.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the Mechanical/Electrical Unfinished Building Occupancy Checklist. The checklist shall be issued by the Engineer's Representative during the course of the project, however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the Contractor when the information required for occupancy is submitted. The Engineer's Representative shall review the information and checklist and will identify when the information is complete. The Engineer's Representative's general review letter (required for building occupancy) will only be issued when the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Engineer's Representative.

1.10. CO-OPERATION WITH OTHER DIVISIONS

- 1.10.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.
- 1.10.2. Pipes transporting hot fluids shall be installed at least 150 mm (6 in.) away from pipes carrying cold fluids, unless approval from the Engineer's Representative is obtained to install services closer than 150 mm (6 in.).
- 1.10.3. Electrical conduits shall not touch or be supported from piping or ductwork.
- 1.10.4. Each Section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other Sections or Divisions. Where the space allocated to another Section or Division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various Sections and Divisions. Relocation of materials and work involved shall be paid for by the Section responsible for the encroachment at no additional cost.
- 1.10.5. Supply all items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.

1.11. TEMPORARY USE OF EQUIPMENT

- 1.11.1. Where systems, or a part thereof, are operated during construction, the Contractor shall maintain the system and equipment in proper operating condition.
- 1.11.2. Prior to application for substantial performance of the work as certified by the Engineer's Representative, the systems and/or equipment shall be returned to new condition by replacing all consumables such as air or water filters, belts in belt driven equipment, etc. with new components. This Contractor shall clean the air side of all coils in the air handling systems, lubricating all bearings according to manufacturer's factory standards and adjust the thermostatic control system according to Specifications. This Contractor shall clean all duct systems to NADCA Standards.

1.12. EXISTING SERVICES AND EQUIPMENT

- 1.12.1. Provide temporary filters, 1 in. thick disposable media type, over all return air openings in the base building HVAC systems that remain in operation during construction. Maintain and replace the temporary filter media as required to prevent construction dust from fouling the base building equipment. Remove same at the completion of construction. Filters in all base building air handling equipment i.e., Air Handling Units, Induction Units, Fan Coil Units, etc., shall be replaced after construction is completed

- 1.12.2. Reuse existing materials and equipment wherever possible. Provide new materials and equipment as required to ensure a complete installation. All existing equipment, materials and associated controls not used in this contract shall be packaged and turned-over to the Landlord. Include in the tender for all shipping and placement in a designated on-site storage location. Remove any equipment or material not wanted by the Landlord from the site.
- 1.12.3. All changes and connections to existing services shall be made only in a manner and at a time approved by the Engineer's Representative so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, without additional cost.
- 1.12.4. Prior to operating any existing or new equipment during any stage of construction, approval from the Landlord and Engineer's Representative must be received in writing
- 1.12.5. Whenever existing services or equipment are to be removed, all piping and ducts for such services or equipment shall be removed back to the main, nearest pipe or duct and any open ends securely capped or plugged in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this Contractor without additional cost.
- 1.12.6. Whenever it becomes necessary to relocate existing piping, ducts or equipment to make possible installation of the work under this Contract, such relocation shall be done by this Contractor without additional cost.
- 1.12.7. Where connections are made to existing services, existing insulation shall be made good under this Division.
- 1.13. **INTERRUPTION OF SERVICES**
 - 1.13.1. All shutdown, draining, filling and chemical treatment for any portion of the existing base building systems shall be performed to the satisfaction of the Landlord's building operations staff and shall be co-ordinated with the Landlord for time and duration of interruptions. Comply with all of the Landlord's instructions and include for all costs of this work, including work performed by the Landlord's chemical treatment supplier, in the tender price.
 - 1.13.2. Any interruption of the mechanical services to any part of the building shall come at a time agreeable to the Landlord. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.
 - 1.13.3. Testing and operation of major equipment shall be approved by the Engineer's Representative to avoid excessive utility charges. Such testing is to be generally carried out after normal working hours or on weekends.
 - 1.13.4. All such overtime work shall be carried out without additional cost.
- 1.14. **STATEMENT OF PRICES**
 - 1.14.1. For the purpose of progress applications the Contractor shall submit a summary statement of their estimated prices for the various portions of the work, including labour, materials and equipment shown separately. The total price of all portions of the work shall equal the total price of the work covered under Divisions 20, 21, 22, and 23.

- 1.14.2. The Contractor shall submit the summary of work for this Contract to the Engineer's Representative for review and approval. The summary shall be in sufficient detail to enable the Engineer's Representative to evaluate the progress of work and shall identify all major equipment, components and sub trades.
- 1.15. **DEMOLITION**
 - 1.15.1. The Drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected. Open shafts, walls and ceilings as required to examine the services.
 - 1.15.2. If there are no isolating valves readily available to isolate sections of pipe that requires removal, add valves as required. The cost of these valves will be paid for from the Cash Allowance Section. Co-ordinate with the Engineer's Representative to shut-down the system. Install caps on all services. Add cap to all valves at the termination point of existing services.
 - 1.15.3. Where valves are removed, remove valve tags, revise existing charts and hand tags over to Owner.
- 1.16. **SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP**
 - 1.16.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.
 - 1.16.2. Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Conditions and conform to all requirements.
 - 1.16.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. In particular no open flames shall be used without prior written approval of the Owner. There shall be no smoking, and the site shall be kept clean at all times.
- 1.17. **MECHANICAL DIVISIONASHRAE 90.1**
 - 1.17.1. All mechanical equipment shall comply with the minimum efficiency standards set out in ASHRAE 90.1 and the National Energy Code of Canada for Buildings. Submit all necessary information to substantiate conformance.
- 1.18. **HOISTING FACILITIES**
 - 1.18.1. This Division shall provide its own hoisting facilities.
 - 1.18.2. Hoisting facilities provided by the General Contractor may be available for Sub-Contractors use. If the General Contractor's hoist facilities are inadequate then Sub-Contractors shall provide their own. This Division shall coordinate requirements with the General Contractor prior to submission of Tender.

GOLDRING STUDENT CENTER
150 CHARLES ST. W.,
TORONTO, ON
Project Number: **23501.003.M.001**

Section 20 05 00.00
General Instructions for Mechanical Sections

1.19. INTELLECTUAL PROPERTY

- 1.19.1. The Contractor acknowledges, represents, warrants and agrees that the Owner, its Consultants, and the Engineer's Representative are not responsible, and hereby indemnified against any action as a result of patent infringement made through the review, acceptance, or receipt of materials, equipment, work, etc. provided by the Contractor or any of their suppliers or manufacturers in the execution of this Contract.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

20 05 02.00
Record and As-built Drawings

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. Refer to Record and/or As-built Drawings in Section 01 70 00.00 (01 72 29.00) - CLOSEOUT SUBMITTALS.
 - 1.3. RECORD OF REVISIONS ON SITE
 - 1.3.1. Print and maintain two complete sets of white prints to mark the project progress, changes and deviations.
 - 1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.
2. Products
 - 2.1. NOT USED
3. Execution
 - 3.1. DOCUMENTATION REQUIREMENTS
 - 3.1.1. As the project progresses record all changes and deviations..
 - 3.1.2. Maintain an accurate dimensional record of revisions. Specifically record:
 - .1 Above ground piping revisions
 - .2 Duct revisions
 - .3 Equipment revisions
 - .4 Locations of access doors and panels. Identify the equipment and components they serve.
 - .5 Locations of valves
 - 3.1.3. Keep revisions up-to-date during construction including change orders, change directives, and site instructions. Documentation shall be available for review at all times.

- 3.2. Final as-built documents shall not contain markings or corrections electronically or by hand (i.e. marker, pen, pencil, etc.). Drawings submitted that contain mark-ups will not be accepted.
- 3.3. SUBMISSION REQUIREMENTS
- 3.3.1. On completion of the Work, submit the draft documentation indicating all such changes and deviations for review by the Engineer's Representative. Submit all documents in PDF format.
- 3.3.2. Upon return of the "Reviewed" draft submittal, transfer "As-Built" information and any additional submittal comments to the final software submission requirement (i.e. Autodesk AutoCAD or Autodesk Revit MEP).
- .1 Request the acceptable version(s) of the software that may be used. Owner shall confirm the acceptable software version upon receipt of request. If the Owner has no preference, the latest published version shall apply.
- .2 Conform to the Owner/Engineer's Representative's standards.
- .3 The Mechanical Contractor may request from the Engineer's Representative the most current electronic documentation in AutoCAD Documents to be forwarded via a secure file transfer (at a nominal charge of \$500.00).
- .4 Clearly label electronic files with Engineer's Representative and Owner, Contract number, file names and the Drawing number.
- 3.3.3. Submit the documents in PDF along with the submission of the completed electronic source software documentation on an approved electronic storage device for review by the Engineer's Representative.
- 3.3.4. The project will remain incomplete and monies retained until a satisfactory as-built submission is provided.
- 3.4. AUTOCAD SPECIFIC SUBMISSION REQUIREMENTS
- 3.4.1. Submit a complete list of symbol (block) names with a description of each symbol.
- 3.4.2. Make special effort to ensure that drafting is accurate, i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and that entities are placed on correct layers.
- 3.4.3. Use the standard fonts available in the software. Do not use custom fonts, shape files, etc.,.
- 3.4.4. Provide all drawings in the same scale of measurement and units as issued on Bid Documents.

END OF SECTION

20 05 03.00
Shop Drawings

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. Comply with Section 01 33 00.00 (01 33 23.00) for Submittals except as amended below.
2. Products
 - 2.1. SHOP DRAWINGS
 - 2.1.1. Submit shop drawings organized by Specification Section. Do not combine more than one Section into one submission. Incorrect submissions will be returned without review.
 - 2.1.2. Submit shop drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:
 - .1 S+A project number and Contractor Shop Drawing Identifier in Subject Line
 - .2 Attachments shall be limited to 10MB
 - .3 Provide FTP hyperlink for all attachments in excess of 10MB with appropriate information for downloading the file (as required)
 - .4 Shop Drawing Submission to the following email address:
 - .1 ContractAdmin.Toronto@smithandandersen.com
 - 2.1.3. Shop drawings submitted directly Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.
 - 2.1.4. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
 - 2.1.5. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.
 - 2.1.6. Provide a cover sheet with the project name, issue date, issue number, Specification section number, title of section and with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

3. Execution

3.1. SUBMISSIONS

- 3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that they have checked the submission for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review.
- 3.1.2. Scanned PDF versions are not acceptable.
- 3.1.3. Installation of equipment or connecting services shall not start until after final review of Shop Drawings by the Engineer's Representative has been completed.
- 3.1.4. Provide all necessary copies required for the trades, suppliers or other Consultants.

END OF SECTION

20 05 29.00
Hangers and Supports

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.
- 1.1.3. Hangers, supports shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. The Mechanical Division shall prepare detailed shop drawings showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall bear the signed seal of a Professional Engineer licensed to practice in the appropriate discipline and place of work. The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the project Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division. No anchor points shall be permitted without reviewed shop drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

2. Products

2.1. MATERIALS

- 2.1.1. Provide hangers and supports manufactured by Anvil International, Taylor Pipe Supports, or E. Myatt & Co.
- 2.1.2. All pipe hangers and supports shall be manufactured to the latest requirements of MSS-SP-58. Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME Code for Pressure Piping B31.1.

3. Execution

3.1. INSTALLATION

- 3.1.1. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent undue stress to building structural components.

- 3.1.2. Piping shall be supported from walls, beams, columns, and slabs using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies shall receive approval prior to installation. Prior approval shall be given for any cutting or drilling of building structural steel. Damage or modification to the structure through welding, cutting, or drilling shall not be permitted if it reduces the integrity of the building structure as deemed by the Structural Engineer's Representative. It shall be the responsibility of the Mechanical Division to supply anchor bolts and base diagrams for equipment and pipe supports showing exact location of attachments.
- 3.1.3. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
- 3.1.4. Auxiliary structural members shall be provided under the Mechanical Section concerned where piping, ducts or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Auxiliary structural members shall be the same material and finish as the primary structure (i.e. prime painted, galvanized, etc.). Submit details for review as requested.
- 3.1.5. Depending on the type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.6. For precast concrete construction, hanger rods shall pass between slabs and be supported on the slab within the topping by a 100mm x 100mm x 3mm (4 in. x 4 in. x 1/8 in.) steel plate welded to the hanger rod. A lock nut threaded to the hanger rod together with a 50mm (2 in.) minimum dia. washer shall be applied tight against the under surface of the deck to prevent rising of the hanger.
- 3.1.7. Approved type expansion shields and bolts may be used for pipe up to 100mm (4 in.) diameter where the presetting of concrete inserts is not practical. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.8. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer's Representative. Drawings of the proposed method of suspension must be submitted for review.
- 3.1.9. Hanger rods shall be subject to tensile loading only. Suspended piping shall be supported by adjustable hanger rods sized as follows:

Pipe Size	Hanger Rod Diameter
50mm (2 in.) and under	9mm (3/8 in.)
65mm (2-1/2 in.) and 75mm (3 in.)	12mm (1/2 in.)

- 3.1.10. Unless otherwise specified or shown hanger spacing for all services shall be as follows:

Nominal Pipe Diameter	Maximum Span
Up to and including 25mm (1 in.)	2.1 m (7 ft.)
32mm (1-1/4 in.) to 125mm (5 in.)	3 m (10 ft.)

- 3.1.11. In addition, provide a hanger within 600mm (2 ft.) on each side of valves, fitting or tees on pipes 38mm (1½ in.) diameter and larger.

- 3.1.12. Hanger spacing for plumbing and drainage services shall be in accordance with the plumbing code or municipal by-laws as applicable.
- 3.1.13. Hanger spacing for fire protection services shall be in accordance with the NFPA codes.
- 3.1.14. All horizontal piping 50mm (2 in.) diameter and larger shall be supported by adjustable wrought iron clevis type hangers. Smaller piping shall be supported by adjustable split ring hangers or clevis type hangers.
- 3.1.15. Suspending one hanger from another shall not be permitted.
- 3.1.16. For hot water or steam piping 38mm (1-1/2 in.) and smaller, use line size hangers.
- 3.1.17. For cold water services such as domestic cold water and hot water pipe 25mm (1 in.) and smaller, install a section of high density insulation complete with continuous vapour barrier between the pipe and the hanger. Refer to Section 20 07 00.00 - MECHANICAL INSULATION.
- 3.1.18. The shield width shall be minimum 1/4 of the pipe circumference. The length and gauge shall be as follows:
- 3.1.19. Hangers and riser clamps in contact with copper pipe shall be copper coated construction or plastic coated. Taped hangers and riser clamps shall not be accepted.
- 3.1.20. Other means of support shall be as shown or as specified hereunder.
- 3.1.21. For special equipment supports refer to equipment sections. Where no support method is identified secure wall mounted equipment to metal framing or masonry, with steel toggle or expansion fasteners, machine screws or sheet metal screws as applicable. Plastic, fibre or soft metal inserts shall not be acceptable. Wall mounted equipment shall not exceed 45.5 Kg (100 lbs) in weight or 250mm (10 in.) in depth unless reviewed or detailed by the Engineer's Representative. Where framing does not permit direct attachment, provide metal strut sub-framing or minimum 19mm (3/4 in.) fire retardant treated plywood backboards, unpainted, attached to the framing. Provide attachments for backboards at 600mm (24 in.) on centres with no less than 4 attachments.

END OF SECTION

20 05 48.00
Vibration and Noise Control

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. None.
 - 1.3. SUBMITTALS
 - 1.3.1. None.
 - 1.4. PERFORMANCE REQUIREMENTS
 - 1.4.1. Adequately isolate all equipment to maintain acceptable noise levels in the occupied area of the building as specified below. Take noise measurements over the complete audible frequency range in each of the occupied zones under, above and beside Mechanical Equipment Rooms, and where indicated by the Engineer's Representative. Noise levels due to mechanical equipment, ductwork, grilles, registers, terminal devices, diffusers, etc, shall not exceed sound pressure levels in all 8 octave bands corresponding to the NC levels per ASHRAE handbook as indicated.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.
 - 2.1.2. All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control, VMC Amber Booth, or Mason Industries and shall be one manufacturer throughout the project.
 - 2.1.3. Provide vibration isolation devices for all motorized or electrical equipment. Static deflection of isolators shall be as given in the Vibration Isolation Schedule and/or as specified below. The Vibration Isolation Schedule shall take precedence.
 - 2.2. VIBRATION ISOLATION
 - 2.2.1. Type SPNH (Spring and Neoprene Hangers) - Vibro-Acoustics Model SHR, Kinetics Model SRH, or Mason Industries Model 30N
 - .1 Type SPNH shall be as above with the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9mm with a strain not exceeding 15%. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).

- 2.2.2. All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.
- 2.2.3. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.
- 2.2.4. All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.
- 2.2.5. Neoprene mounting sleeves for hold down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

2.3. INTERNAL ACOUSTIC DUCT LINING

- 2.3.1. Fiberglass duct liner shall be manufactured by Certainteed, Owens-Corning, Knauf Insulation, or Johns Manville.
- 2.3.2. Natural fibre duct liner shall be manufactured by Bonded Logic.
- 2.3.3. Duct lining shall have a minimum density of 24 kg/m³ (1.5 lbs/ft³).
- 2.3.4. Duct liner shall comply with the requirements of NFPA 90A and the "Duct Liner Materials Standard" of the Thermal Insulation Manufacturer's Association.
- 2.3.5. Duct sizes shown on the Drawing are free area dimensions (after the installation of duct liner). Duct liner shall be a minimum of 25 mm (1 in.) unless shown otherwise.
- 2.3.6. All acoustical duct lining shall incorporate means to prevent fiber entrainment in the air stream.
- 2.3.7. The following ductwork shall be internally lined:
 - .1 All ductwork specifically identified in Specifications and/or on the Drawings.
 - .2

2.4. SOUND BAFFLES

- 2.4.1. Sound baffles indicated on the drawing shall be 2 layers of 4.9 kg/sq. m. (1 lb/ sq. ft.) sheet acoustic barrier material installed in the perimeter induction enclosures and centred on adjoining partitions. Seal sheets to enclosure and around all piping etc. inside the enclosures. Cover the acoustic sound barrier sheet with drywall on both sides to ensure the acoustic sheets are encapsulated. Acoustic barrier shall be Kinetics KNM or AcoustiGuard Noise-Blok.

3. Execution

3.1. INSTALLATION

- 3.1.1. On system start-up, inspect the complete installation and provide a report in writing.
- 3.1.2. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

- 3.1.3. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping, and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.
- 3.1.4. All wiring connections to mechanical equipment on isolators shall be made with a minimum long flexible conduit installed in a slack "U" shape.
- 3.1.5. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.
- 3.1.6. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

3.2. EQUIPMENT ISOLATION

- 3.2.1. The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.
 - 3.2.2. Flexible piping connectors shall be installed to connect piping of diameter 50 mm (2 in.) or greater to reciprocating or rotating equipment.
 - 3.2.3. No rigid connections between equipment and the building structure shall be made that degrades the specified noise and vibration control system.
 - 3.2.4. Any conflicts with other trades which result in rigid contact with the equipment or piping due to inadequate space or other unforeseen conditions should be brought to the Engineer's Representative's attention prior to installation. If not brought to the attention of the Engineer's Representative prior to installation corrective work necessitated by conflicts shall be at the Contractor's expense.
 - 3.2.5. Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.
- .1 Flexible connectors shall be in accordance with Section 23 31 13.00 - DUCTWORK AND SPECIALTIES.

3.3. ACOUSTICAL LINING OF DUCTS

- 3.3.1. Ductwork shall be acoustically lined where shown on the Drawings and as Specified.
- 3.3.2. Acoustical duct lining shall be a minimum of 25 mm (1 in.) thick in all internally lined sheet metal ducts, unless otherwise specified or shown on the Drawings.
- 3.3.3. The acoustic liner shall be fixed to the duct with a minimum of 50% coverage of a fire-resistant adhesive. Where the duct width exceeds 300 mm (12 in.) or the height 600 mm (24 in.), the liner shall be additionally secured with mechanical fastening on maximum 450 mm (18 in.) centers on all sides. Mechanical fasteners that pierce the duct are unacceptable. Mechanical fasteners shall be in accordance with Section 20 07 00.00 - MECHANICAL INSULATION. All ends of the liner shall be coated with a fire resistant cementing material to prevent delamination, leakage or erosion. All joints shall be firmly butted and ends coated with an adhesive to ensure that the lining is smooth across all joints.

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- 3.3.4. Where acoustical duct lining is installed, the dimensions of the sheet metal shall be increased to include the thickness of the lining material. Dimensions shown on the Mechanical Drawings are the clear internal dimensions after the liner has been installed.

END OF SECTION

20 05 63.00
Access Doors and Accessibility

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Submit Drawings showing size, type and location of all access doors, for review, before installation.

2. Products

2.1. MATERIALS

- 2.1.1. Access doors shall be Acudor, or Mifab Manufacturing Inc.
- 2.1.2. Doors in solid walls shall be with a 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges, flanged frame, and screwdriver operated lock. Acudor Model UF 5000 or Mifab Model UA.
- 2.1.3. Doors in drywall partitions or ceilings shall be 16 US gauge, prime painted steel recessed door panel for the acceptance of a drywall insert, concealed hinges, drywall bead frame, and screwdriver operated lock. Acudor model DW 5015 or Mifab Model CAD-DW.
- 2.1.4. Doors in drywall partitions or ceilings shall be 14 US gauge, prime painted steel flush door panel, concealed hinges, drywall bead frame, and screwdriver operated lock. Acudor model DW 5040 or Mifab Model MDW.
- 2.1.5. Access doors in fire rated walls or ceilings shall be ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, flanged frame, and prime painted. Provide master key operated catch in areas accessible to the public. Acudor Model FW 5050 or Mifab MPFR.
- 2.1.6. Doors in tiled walls or ceilings shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock. Acudor Model UF 5000 or Mifab Model UA-SS.
- 2.1.7. Minimum size of doors shall be 300 mm x 450 mm (12 in. x 18 in.). Wherever possible 600 mm x 600 mm (24 in. x 24 in.) doors shall be used.

3. Execution

3.1. INSTALLATION

- 3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever valves, dampers and other appurtenances are concealed by building construction, access doors shall be furnished by this Section and installed under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.) This Section is responsible for the proper location of the access doors.
- 3.1.2. Wall mounted plumbing fixtures with back water connection shall have an adjacent access door.

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- 3.1.3. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).
- 3.1.4. Group items in order to minimize the number of access doors required.
- 3.1.5. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.
- 3.1.6. Make any changes to locations of access doors as directed by the Engineer's Representative.
- 3.1.7. The final installed locations of all access doors shall be shown on the As-Built Record Drawings.

END OF SECTION

20 05 83.00
Sleeves and Escutcheons

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. Firestopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers, etc.) with the exception of sleeves shown for future use installed in fire or smoke rated partitions shall be the responsibility of Mechanical Division. All other firestopping and smoke seals of mechanical services are part of Mechanical Division.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Sleeves passing through stud partitions shall be 0.75 mm (0.0299 in. - 22 G.S.G.) steel.
 - 2.1.2. Sleeves passing through concrete or masonry partitions shall be Schedule 40 steel pipe.
 - 2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal.
 - 2.1.4. Firestopping and smoke seal systems shall be in accordance with CAN4-S115 - Standard Method of Fire Tests for Firestop Systems, CAN/ULC-S101 - Standard Methods for Fire Endurance Tests of Building Construction and Materials, ASTM E119 - Standard Test Methods for Fire Tests of Building and Construction Materials, and ASTM E814 - Standard Test for Fire Tests of Through-Penetration Firestop Stops.
 - .1 Unless noted otherwise "F" and "T" ratings are shown on the drawings.
 - .2 Systems shall be asbestos free and maintain an effective barrier against flame, smoke, and gases in accordance with CAN4-S115 and shall not exceed opening sizes for which they are intended.
 - .3 Firestopping and smoke seals at openings around mechanical services shall be an elastomeric seal for sound and vibration control.
 - .4 Fire resistance rating of firestopping assembly shall not be less than the fire resistance rating of surrounding floor or wall assembly.
 - .5 Service penetration assemblies shall be ULC certified in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.
 - .6 Service penetration firestop components shall be ULC certified in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15.
 - .7 Firestopping and smoke seals shall be by Hilti, Tremco/Royal Quickstop, or 3M.
 - .8 Firestop products shall be mold and mildew resistant

- 2.1.5. Escutcheons shall be satin finish stainless steel or satin finish chrome or nickel plated brass, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks may be used. For escutcheons for plumbing fixtures refer to Section 22 42 00.00 - FIXTURES AND TRIM.
- 2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work. For floors and walls with a fire resistance rating, build fire damper assemblies into structure to attain fire rated construction, in a manner acceptable to the governing authorities.

3. Execution

3.1. INSTALLATION

- 3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Mechanical Division for the mechanical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.
- 3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer's Representative.
- 3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers.
- 3.1.4. Sleeves shall be sized to maintain insulation and vapour barrier around all pipes and ducts for all service penetrations. Coordinate thickness requirements with Section 20 07 00.00 - MECHANICAL INSULATION.
- 3.1.5. For sleeves through barriers without a fire resistance rating, for non-insulated pipe, fill the annular space between the service and the sleeve with insulation as specified in Section 20 07 00.00 - MECHANICAL INSULATION and caulk around the edges with sealant.
- 3.1.6. Firestopping and smoke seal material and components shall be installed in accordance with the ULC certification and manufacturers instructions. Examine the sizes and conditions of the cavities to be filled to determine the correct thicknesses and installation of materials. All substrates and surfaces in contact with firestopping materials shall be dry and prepared in accordance with the Manufacturers instructions at appropriate ambient conditions.
- 3.1.7. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.
- 3.1.8. Provide escutcheons at all penetrations of piping into finished areas, and at insulated pipes, make the escutcheons large enough to fit around the insulation.

END OF SECTION

20 05 88.00
Cutting and Patching

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Openings required for mechanical services for new construction shall be in accordance with Section 20 05 83.00 - SLEEVES AND ESCUTCHEONS. This Section shall apply for openings required in existing construction or where sleeves for mechanical services have been omitted in new construction in error.
- 1.1.3. Include for all cutting and patching for all mechanical services for holes and openings with dimensions up to 200 mm (8 in.) in size and related patching. Perform cutting and patching work in accordance with requirements of Section 01 60 00.00 - PROJECT FORMS.
- 1.1.4. Cutting and Patching shall be in accordance with Section 01 60 00.00 - PROJECT FORMS.

2. Products

2.1. MATERIALS

- 2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Section 01 60 00.00 - PROJECT FORMS, and shall be carried out by professional workers experienced in the cutting and patching work to be done.

3. Execution

3.1. INSTALLATION

- 3.1.1. Locate all openings in non-structural elements requiring cutting and patching in cooperation with the applicable Trades in a timely manner to avoid unnecessary cutting. All openings shall be shown on Drawings and submitted to the Engineer's Representative for review. No holes through structure shall be permitted prior to review by the Structural Engineer's Representative.
- 3.1.2. Core drilling for individual services shall be by this Division. Cut all openings no larger than is required for the services.
- 3.1.3. Locate all openings in structure elements requiring cutting and patching and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar and completely avoid electrical conduit.
 - .1 Cut holes through slabs only.
 - .2 Do not cut holes through beams.
 - .3 Holes to be cut are 200 mm (8 in.) (diameter) or smaller only.

- .4 Maintain at least 100 mm (4 in.) clear from all beam faces. Space at least 3 hole diameters on Centre.
- .5 For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.
- .6 For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.
- .7 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity.
- 3.1.4. Obtain written approval from the Landlord and the Structural Engineer's Representative before cutting or core drilling openings or holes.
- 3.1.5. Patch all openings after services have been installed to match the surrounding finishes.

END OF SECTION

20 07 00.00
Mechanical Insulation

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 21 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Provide shop drawings with technical data on all types of insulation to be installed.
- 1.1.3. Provide two samples of each type of insulation indicating where each is to be used and a sample of a typical vapour barrier dam. Samples shall be mounted on boards. One shall be kept at the Contractor's site office and the other shall be turned over to the Engineer's Representative.

2. Products

2.1. MATERIALS

- 2.1.1. Fibreglass insulation shall be Owens-Corning, Certainteed, Manson, Johns Manville, Knauf or Fibrex.
 - .1 Duct insulation shall be rigid board vapour seal 48 kg/cu.m. (3 lbs/cu.ft.) density duct insulation with factory applied vapour barrier.
 - .2 Flexible duct insulation shall be 12 kg/cu.m. (3/4 lb.cu.ft.) type with vapour barrier.
 - .3 Pipe insulation shall be preformed sectional fibreglass or mineral wool insulation with factory applied all service jacket.
- 2.1.2. All cements and adhesives shall be as recommended by the manufacturer of the insulation. Insulation, insulation jacket, canvas and adhesive shall be fire retardant with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50 when tested in accordance with CAN/ULC-S102-M.
- 2.1.3. Provide all insulation, adhesives, coatings, and jacket systems for indoor applications that are Certified under the GREENGUARD Environmental Institute (GEI) Certification Program for low chemical and particle emissions for indoors,

3. Execution

3.1. INSTALLATION

- 3.1.1. Install insulation in accordance with the manufacturer's printed installation instructions unless noted otherwise.
- 3.1.2. Insulation thicknesses and conductivities shall meet or exceed the minimum standards set out in ASHRAE 90.1 (refer to Table 1 following) and as specified herein for the services covered.
- 3.1.3. Apply insulation to clean, dry surfaces only while ambient temperature is at least 10 Deg. C. (50 Deg. F.).

- 3.1.4. Where vapour barrier dams are called for, terminate the insulation and seal the vapour barrier to the pipe or ductwork using a mesh embedded in a vapour barrier mastic. Provide dams at valves, fittings used for servicing, groups of other types of fittings, irregular shaped objects at floor and wall penetrations, and at 15 m (50 ft.) intervals of straight pipe or straight ductwork for the following services: water piping that is less than 80 deg. F., including but not limited to the following:
 - .1 Domestic cold water piping
- 3.1.5. Terminate insulation on pipes passing through fire rated walls or floors, and fit tight to the fire stop material.
- 3.1.6. Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.
- 3.1.7. On piping systems specified to be insulated, include insulation on valves, flanges, couplings and unions.
- 3.1.8. Do not use staples to secure joints of insulation jackets.
- 3.1.9. Hot Services
 - .1 On hot services, insulate valves, fittings, couplings, unions, flanges and all other appurtenances through which the fluid passes, using mitred sections of preformed insulation of a thickness equal to the adjoining pipe insulation, and securely wire in place. Over mitred section, apply one coat of field applied mesh reinforced mastic. Finish services with a vapour barrier using two full brush coats of vapour seal adhesive.
 - .2 Apply glass fibre preformed vapour barrier jacket pipe insulation to domestic hot water piping. Refer to Table 1 following for required insulation thickness. Apply with all joints butted firmly together, and bond securely, sealing flaps by pasting down to give a smooth finish.
 - .3 Apply 50 mm (2 in.) thick mineral fiber tank wrap insulation (wired on) to the following:
 - .1 All domestic hot water tanks
- 3.1.10. Cold Services
 - .1 For domestic cold water piping less than 75 mm (3 in.) where hangers on cold water lines penetrate vapour barrier make sure the penetration is properly sealed with insulation and vapour barrier continued up hanger a further 75 mm (3 in.).
 - .2 Apply 12 mm (1/2 in.) thick, preformed glass fibre pipe insulation with vapour barrier jacket or 12 mm (1/2 in.) thick flexible elastomeric insulation to all domestic cold water piping.
 - .3 On cold water service valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges and other irregular shaped objects, apply flexible elastomeric sheet insulation, thickness to suit service, cut and mitre as necessary, and attach with adhesive and stainless steel banding. Bond and seal edges of insulation to the adjacent surfaces and finish with field applied mesh reinforced mastic.
 - .4 Refer to the Table 1 for required insulation thicknesses.
- 3.1.11. Drainage Piping

- .1 Cover cast iron drainage pipe 75 mm (3 in.) and smaller with 12 mm (1/2 in.) preformed glass fibre pipe insulation, and finish with vapour barrier jacket. Seal band to the fibreglass insulation. Apply 25 mm (1 in.) thick insulation for all larger pipes.
 - .2 Sanitary drainage piping to be insulated:
 - .1 All piping passing through high humidity areas
- 3.1.12. Ductwork and Equipment
- .1 Ductwork and equipment internal to the building within conditioned spaces shall have 25 mm (1 in.) thick rigid glass fibre duct insulation with vapour barrier. In conditioned concealed spaces and on round duct smaller than 600 mm (24 in.) insulation may be 38mm (1-1/2 in.) flexible type with vapour barrier. Flexible duct connections do not require insulation except where a factory applied insulation has been specified with the flexible duct connection.
 - .2 Butt join insulation and attach with pins and speed washers, one per 0.186 sq.m. (2 sq.ft.), but not more than 450 mm (18 in.) apart in any direction. Apply fire resistive adhesive in 100 mm (4 in.) wide strips on 300 mm (12 in.) centres. Seal all joints with adhesive and apply vapour barrier tape. Install pins of suitable length for the thickness of insulation and clip flush after final installation of washers. Tack weld pins to sheet metal.
 - .3 Insulation Contractor shall coordinate with sheet metal contractor to ensure duct insulation is applied prior to ductwork being installed to underside of slabs, beams or other services or behind other duct risers and shafts.
- 3.1.13. Insulate the following ductwork and equipment:
- .1 All supply ductwork from fans to VAV box for variable volume systems and all supply ductwork on constant volume systems.

3.1.14. TABLE 1: MINIMUM PIPE INSULATION THICKNESS/PERFORMANCE (BASED ON ASHRAE 90.1 AND MODEL NATIONAL ENERGY CODE FOR BUILDINGS)

3.1.15. Minimum Pipe Insulation - mm (in.)

.1 Domestic Hot Water Systems^c

Fluid Design Operating Temp. range deg. C. (deg. F.)	Insulation Conductivity [W(m-K)] [h-cu.ft. - deg. F. (Btu-in.)]	Mean Rating Temp deg. C. (deg. F.)	Nominal Pipe Diameter - mm (in.)					
			Runouts ^b Up to 32 (1-1/4)	Less than 25 (1)	25-32 (1 to 1- 1/4)	38-75 (1-1/2 to 3)	100- 150 (4- 6)	200 (8) and up
41-60 (105 -140)	0.040 (0.28)	38 (100)	25 (1.0)	25 (1.0)	25 (1.0)	38 (1.5)	38 (1.5)	38 (1.5)

^c Applies to recirculating sections of service or domestic hot water systems and first 2.4 m (8 ft.) from storage tank for non-recirculating systems.

END OF SECTION

21 13 00.00
Sprinkler Systems

1. General

1.1. WORK INCLUDED

- 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
- 1.1.2. Sprinkler system shall conform to applicable NFPA Standards and to all authorities' requirements.

• DESCRIPTION OF SYSTEM

- 1.1.3. The sprinkler systems shall be wet type as shown, consisting of distribution and interconnecting piping, sprinkler heads, hangers and all necessary equipment to provide a complete sprinkler system ready for immediate operation.

1.2. DENSITY AND AREA REQUIREMENTS

- 1.2.1. The following minimum density and area requirements shall be the basis of the hydraulic design. Any request for modifying the density requirement shall be submitted by the Contractor for review by the Engineer's Representative.

Location Served	Hazard	Density L/m/sq. m. (gpm/sq. ft)	Area Sq. m. (sq. ft)	Remarks
Office Areas	Light	4.1 (0.10)	139.5 (1500)	Wet Type. Loop main shall have the capacity to serve 5 additional sprinkler heads at the most remote 139.5 sq.m. (1500 sq.ft.) area of application.
Lobby, suite and amenity space	Light	4.1 (0.10)	139.5 (1500)	Wet Type. Loop main shall have the capacity to serve 5 additional sprinkler heads at the most remote 139.5 sq.m (1500 sq.ft.) area of application

1.3. SUBMITTALS

- 1.3.1. Shop Drawings: Submit sprinkler drawing layouts in accordance with Section 21 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS showing all component parts complete with Shop Drawings of all valves and accessories to I.A.O. (F.M.) and to the Engineer's Representative for review. These drawings shall be designed and bear the signed stamp of an engineer licensed to --practice in the appropriate discipline and in the Place of Work. The Contractor's design Engineer shall provide periodic review in accordance with all applicable requirements of their licence and shall sign and seal an occupancy letter indicating the installation is in conformance with their design.
- .1 Clearly indicate on sprinkler layout drawings the location of all drain connections.
 - .2 Prepare complete sprinkler layout drawings, arranging piping runs and sprinkler heads in proper relation with bus ducts, air conditioning ducts, piping, etc., and to ensure clear ceiling heights indicated on the drawings. Where piping occurs in ceiling spaces, keep piping above level of top of lighting fixtures.
- 1.3.2. Submit hydraulic calculations in approved formats.

1.4. QUALIFICATIONS .

- 1.4.1. The installation company shall be a member of the Canadian Sprinkler Association and regularly engaged in this work.

2. Products

2.1. MATERIALS

- 2.1.1. General:
- .1 All components used in the sprinkler system shall be ULC Listed and FM Approved. UL Listed and/or FM Approved equipment not bearing a ULC listing shall only be acceptable if written approval from the local authority is obtained.
 - .2 All components used in the sprinkler system shall be manufactured in Canada or USA, whenever available.
- 2.1.2. Pipe and fittings less than 1206 kPa (175 psi) working pressure shall be as follows:
- .1 Pipe, black steel, Schedule 40, ASTM A53.
 - .2 Fittings for a minimum of 1206 kPa (175 psi) working pressure, 1035 kPa (150 psi) malleable iron ASME B16.3, 860 kPa (125 psi) cast iron ASME B16.4, butt welding schedule 40 ASME B16.25, or roll grooved Victaulic, Viking Anvil-Gruvlok or Tyco/JCI Grinnell.
 - .3 Acceptable valve manufacturers:
 - .1 Viking Nibco
 - .2 Viking Gruvlok
 - .3 MA Stewart W Series
 - .4 Victaulic
 - .5 Tyco Grinnell
 - .4 All grooved products including couplings, fittings and valves shall be of one manufacturer.

- .5 Provide fittings with grooved connections at all legs of the fitting or couplings equal to Victaulic 920, Tyco/Grinnell Figure 730, or Gruvlok Figure 7045 Clamp-T. Fittings and couplings that are not acceptable are ones equal to Victaulic 921, Tyco/Central Sprinkler Strap 40-5, or Gruvlok Figure 7045 U-bolt.

- 2.1.3. No grooved fittings or products shall be used except for those specified. All grooved products shall be of one manufacturer.
- 2.1.4. Sprinkler heads shall be the automatic spray type, ULC listed and as approved by I.A.O. or F.M. as applicable. Where heads are located close to heating coils, unit heaters or other hot equipment, they shall be of the high temperature type to suit regulations.
- 2.1.5. Unless otherwise specified, hangers shall conform to the requirements of NFPA 13.

3. Execution

3.1. INSTALLATION

- 3.1.1. Spacing of sprinklers shall suit the hazard of the occupancy shown. Where specific locations of sprinkler heads have been shown on Drawings, these shall be maintained. Sizing of piping shall be based on hydraulic design. Submit all calculations to the city, the Owner's Insurers and the Engineer's Representative for review. The calculations shall be designed and bear the signed stamp the engineer.
- 3.1.2. Installation shall conform to all applicable codes.
- 3.1.3. Review all other Sections of the Specifications and include for all work that may affect this section. Pay particular attention to the requirements for valve tags and identification.
- 3.1.4. Fully coordinate the sprinkler piping with that of other trades on the job. Mains and branches shall be run so as not to interfere with the building's structure, electrical, plumbing, ventilation and heating installations. Sprinkler heads shall be located in the centre and/or quarter points of ceiling tile as shown on the reflected installation of additional sprinkler heads.
- 3.1.5. In all office areas, any additional sprinkler heads added to the floor because of increased requirements, shall be piped directly from the loop main.

3.2. TESTING OF SYSTEM

- 3.2.1. All testing shall be executed in accordance with the latest regulations of NFPA 13 and with any other regulations that the authoritative inspector demands.
- 3.2.2. Testing shall include the flushing and cleaning of the entire system.

END OF SECTION

22 05 76.00
Cleanouts

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
 - 2.1. MATERIALS
 - 2.2. FINISHED AREAS
 - 2.2.1. Cleanouts in finished areas with membrane floors shall be coated cast iron body with adjustable nickel bronze frame and round scoriated gas tight access cover with secondary gas tight plug. J.R. Smith 4020-F-C, Zurn ZN 1400-KC, Mifab C1100C-R-1-34, Watts CO-100-C-R-1-34G.
 - 2.2.2. Cleanouts with recess for terrazzo shall be similar to cleanouts in finished areas with membrane floors but shall have terrazzo recess. J.R. Smith 4180-F-C, Zurn ZN 1400-Z-KC, Mifab C1100C-UR-1-34, Watts CO-100-C-R-1-34G.
 - 2.2.3. Cleanouts with recess for tile shall be similar to cleanouts in finished areas with membrane floors but shall have 3 mm (1/8 in.) tile recess. J.R. Smith 4140-F-C, Zurn ZN 1400-X-KC, Mifab C1100C-UR-1-34, Watts CO-100-C-R-1-34G.
 - 2.2.4. Cleanouts for carpeted areas shall be similar to cleanouts in finished areas but shall have stamped stainless steel carpet marker. J.R. Smith 4020-Y, Zurn ZN 1400-CM, Mifab C1100-RC-1-34, Watts CO-100-C-R-1-34G.
 - 2.3. NON-FINISHED AREAS
 - 2.3.1. Cleanouts in non-finished areas shall be all coated cast iron body with heavy duty cast iron or ductile iron top. J.R. Smith 4220-F-C, Zurn Z-1400-KC, Mifab C1100-XR-4-34, Watts CO-100-C-R-1-34G.
 - 2.3.2. Cleanouts at the base of each vertical stack and rain water leader shall be either Daisy or Barrett type.
3. Execution
 - 3.1. INSTALLATION
 - 3.1.1. Cleanouts in furred ceiling spaces shall extend up through floor slab above, except where the Engineer's Representative gives specific approval to its location in the ceiling space.
 - 3.1.2. Cleanouts shall be installed in horizontal drains at each change of direction and as required.

END OF SECTION
2024-02-02

ISSUED FOR TENDER

22 11 13.00
Pipes, Valves and Fittings (Plumbing System)

1. The General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Pipes and fittings shall be in accordance with the following unless specified otherwise by local authorities.
 - 2.1.2. All valves on potable water systems shall be equal in performance to the models specified, shall be lead free or low lead meeting the requirements of CSA B125.3, CSA B125.14, ANSI 372/NSF-61, ANSI/NSF-14, and/or ANSI/AWWA C550 as applicable
 - 2.1.3. All city and domestic water, above grade, 75 mm (3 in.) and smaller, less than 1380 kPa (200 psi) working pressure:
 - .1 Pipe: Copper Tubing, Type "L", Hard Drawn, ASTM B88. Fittings: wrought copper solder joint pressure fittings, ANSI/ASME B16.22 or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18.
 - .2 Joints made with 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32.
 - .3 Grooved end copper fittings conforming to ASTM B75/B75M-11.
 - .4 Drain valves and blow-off valves shall be 4137 kPa (600 psi) WG 19 mm (3/4 in.) ball valves with lead free, bronze body or forged brass body, solid ball, male threaded garden hose end, brass cap and chain equal to Watts B-6000, Toyo 5046-LF, Kitz 868C or Apollo 78-100.
 - 2.1.4. All domestic water above grade 75 mm (3 in.) and smaller, over 1380 kPa (200 psi) working pressure and under 2070 kPa (300 psi) working pressure:
 - 2.1.5. Sanitary drains and vents above grade shall be cast iron or copper pipe installed as in regulations, except where copper pipe is used, joints to be made with 95-5 solder. ABS, asbestos cement (Transite) and PVC pipes are not acceptable.
 - 2.1.6. Ball valves 50 mm (2 in.) and smaller shall be lead free, bronze body or forged brass 4137 kPa (600 psi) WOG, virgin Teflon seat, TFE stem packing and thrust washer, 1/4 turn open-closed operation with solid ball. Ball valves shall be Watts No. B-6000, Toyo 5044A-LF/5049A-LF, Kitz 858/859 or Apollo 70-100/200. Stem extensions shall be provided on all ball valves. Ball valves may be substituted for gate valves only.

2.1.7. Except where special feature are required or unless otherwise approved or noted, all valves shall be of one manufacturer with the manufacturer's name and the pressure rating clearly marked on the outside of the valve body. Valves shall be manufactured by Crane, Jenkins, Toyo or Kitz. Butterfly valves shall be by Keystone, DeZurik, Bray, Challenger, Centerline, Crane, Apollo, Kitz or Victaulic. Non-slam check valves shall be Pro-Quip, Duo CHEK II, Centerline, Mueller or Victaulic. Ball valves shall be Apollo, Watts, Toyo or Kitz. Valves shall be equal to the model numbers specified. .

2.1.8. Water meters located in service rooms or ceiling spaces shall be Neptune model T-10 disc type complete with Pulser RM visual remote read-out. Read-out to be located in base building janitor closet or riser room. Meter shall be size 5/8 in. (0.7 to 7.0 usgpm) or 3/4 in. (7.0 to 15.0 usgpm).

3. Execution

3.1. INSTALLATION

3.1.1. Valves shall be provide as shown and as required for the satisfactory operation and control of all equipment and shall be installed to enable each piece of equipment to be isolated.

3.1.2. Isolation valves shall be installed at the base of each riser and at each branch take-off. Where the equipment is to be isolated within easy view of and not more than 6000 mm (20 ft.) from the main, at the branch take-off, then the branch take-off valve may serve as the equipment isolating valve.

3.1.3. Drain valves shall be installed at each low point in the piping systems and at each tank.

3.1.4. Blow-off valves shall be provided on each 65 mm (2-1/2 in.) strainer and larger.

3.1.5. Globe valves shall be installed as shown and in each bypass.

3.1.6. Install reduced pressure backflow preventers where recommended by CSA B64 and in the following locations:

.1 Where shown on the Drawings

.2 As requested by the Authority having Jurisdiction

3.1.7. Check valves shall be installed as shown and where required to prevent backflow.

3.1.8. Connections between copper and steel pipe shall be made with brass or bronze fittings where other type of connection is not specified in regulations.

3.1.9. All piping shall run parallel with closest wall.

3.1.10. Piping in walk-in pipe spaces shall be installed as close to one wall as possible.

3.1.11. Each water hammer arrester shall be accessible for service and replacement. They shall be installed in compliance with the recommendations of the Plumbing and Drainage Institute as found in Standard PD1-WH201.

3.1.12. Slope all drains and vents in accordance with the plumbing code but not less than the minimum slopes shown on the drawings. Slope all water lines 25 mm in 12 m (1 in. in 40 ft.) unless shown otherwise.

GOLDRING STUDENT CENTER
150 CHARLES ST. W.,
TORONTO, ON
Project Number: **23501.003.M.001**

Section 22 11 13.00
Pipes, Valves and Fittings (Plumbing System)

- 3.1.13. Vent stack covers shall be properly sized for each vent penetrating the roof.
Division 23 shall supply vent stack covers for installation and flashing by the roofing contractor.

END OF SECTION

22 42 00.00
Fixtures and Trim

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. SUBMITTALS
 - 1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Plumbing fixtures shall be as indicated and specified with all required supports, accessories, drainage, vent and water connections to make the fixtures complete.
 - 2.1.2. Fittings that supply water to a fixture shall not exceed the maximum flow rates in accordance with the following:
 - .1 Part 7 of the Building Code
 - 2.1.3. Fixtures shall be American Standard, Crane, Toto, Kohler, Franke, Zurn or Novanni, equivalent to the fixtures specified. American Standard – Eljer and Crane Placidus are not permitted. Fixtures shall be white.
 - 2.1.4. Fittings and trim shall be American Standard, Crane, Kohler, Sloan, Chicago Faucets, Zurn, Moen, Symmons, or Delta/Cambridge except where specified otherwise. All exposed valves, fittings, escutcheons, trim, etc., at each fixture shall be polished chrome plated brass, unless specified otherwise.
 - 2.1.5. Provide Fixtures and Trim equal to product specification sheets. This should be used when the ats style product specification sheets are used.
 - 2.2. GENERAL SINK UNITS
 - 2.2.1. Sinks shown as 'S-1' – Kohler Vault K-3840-3-NA Stainless steel undermount sink.
 - .1 Faucet for sink unit above shall be Elkay LKAV7051FLS – Elkay Avado Single Hole 2-in-1 Kitchen Faucet with Filtered Drinking Water Lustrous Steel
 - 2.2.2. Sinks shown as 'S-2' – Kohler Undertone K-3333-NA Stainless steel undermount sink.
 - .1 Faucet for sink unit above shall be Elkay LKAV7051FLS – Elkay Avado Single Hole 2-in-1 Kitchen Faucet with Filtered Drinking Water Lustrous Steel
 - 2.2.3. "P" trap for all sink units shall cast brass 38 mm (1½ in.) with union, cleanout, and escutcheon, Delta Commercial 33T360, McGuire 8912C, or Zurn Z8702BD-PC.

- 2.2.4. Supplies for all sink units shall be a pair of chrome plated, heavy pattern angle lavatory supplies, lockshield, screw driver slot, stuffing box cartridge, 3/8 in. IPS brass inlet supply nipple, flexible braided stainless steel risers, and stainless steel wall flange. Delta Commercial 47P2512SD, McGuire H165LKN5RB, Zurn ZH-8820-LR-LK-PC-3.

3. Execution

3.1. INSTALLATION

- 3.1.1. Provide necessary plates, brackets, cleats, supports, etc, for rigidly securing fixtures in place. Accurately lay out all roughing piping, avoiding offsets.
- 3.1.2. Examine fixtures for defects. Remove and replace any fixture which, in the opinion of the Engineer's Representative, is damaged. Make necessary adjustments to ensure fixtures function as per manufacturer's operating criteria. Clean and polish all fixtures and trim upon completion.
- 3.1.3. Ensure wall-mounted fixtures with back water connections have an adjacent access door, unless the pipe space is sufficiently wide to allow the water connection to be made from within the pipe space. For this, pipe space shall be 600 mm (24 in.) minimum clear width.
- 3.1.4. Fixtures shall be installed symmetrical with wall tile pattern, unless otherwise dimensioned or shown on Architectural Drawings.

END OF SECTION

23 05 93.23
Testing and Balancing Air Systems

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.1.2. This Section is split into two Sections of work, the Contractors testing and balancing and the Independent Company's testing and balancing.
 - 1.2. INDEPENDENT TESTING AND BALANCING COMPANY PROCUREMENT
 - 1.2.1. The cost for the Independent Company's testing and balancing scope of work shall be paid for under the Allowance Section.
 - 1.2.2. The Mechanical Contractor shall administer and obtain bids from the acceptable Independent Companies and shall submit unopened bids for review and selection by the Engineer's Representative or Owner within 20 days from award of the Mechanical Contract.
 - 1.3. QUALITY ASSURANCE
 - 1.3.1. Balancing companies shall be members of A.A.B.C. or N.E.B.B.
 - 1.3.2. Acceptable balancing companies are limited to the following:
 - .1 Ace Commercial Air Test & Balancing
2. Products
 - 2.1. NOT USED
3. Execution
 - 3.1. GENERAL
 - 3.1.1. Sample of a Test Verification Sheet is provide at the end of the Section and this sheet or a similar one with all pertinent information is to be filled out for all tests called for in the Specification or required by code. The sheets shall be signed by the Contractor and the Independent Company to verify that the data recorded is correct.
 - 3.1.2. The following systems shall be tested and balanced:
 - .1 Air distribution (supply, return and exhaust)
 - 3.1.3. The Contractor shall provide a schedule for all testing and balancing.

3.2. THE CONTRACTORS TESTING AND BALANCING

- 3.2.1. All tests for systems shall be performed in the presence of, and test reports signed by, the Independent Company. Notify the Independent Company in writing a minimum of one week in advance of testing.
- 3.2.2. Co-ordinate with the Independent Company to ensure all necessary manual dampers and splitter dampers for balancing the systems are installed. Notify the Engineer's Representative in writing that this co-ordination has taken place before installation begins. If this Contractor fails to co-ordinate with the Independent Company and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the Contractor at no cost to the Owner.
- 3.2.3. Ensure access is provided to all fire dampers and equipment that requires servicing.
- 3.2.4. The Contractor is responsible for all equipment operating to design conditions and shall change fan sheaves, etc., to provide the required conditions, but is not responsible for balancing the system.
- 3.2.5. The Contractor shall make available staff, as required by the Independent Company, to correct any deficiencies in the mechanical systems which prevent the Independent Company from balancing the system.
- 3.2.6. The Contractor shall provide copies of all Shop Drawings requested by the Independent Company.
- 3.2.7. The Contractor will provide new filters, etc. required for the measurements. Costs of filters shall be paid for.

3.3. THE INDEPENDENT COMPANY'S TESTING AND BALANCING

- 3.3.1. Co-ordinate with the Contractor to ensure that all necessary manual and splitter dampers for balancing are installed in all locations required. Notify the Engineer's Representative in writing that this co-ordination has taken place. Include in this letter any recommendations made regarding dampers, locations, installation, etc. If this Independent Company fails to co-ordinate with the Contractor and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the Independent Company at no cost to the Owners.
- 3.3.2. The Independent Company shall balance the entire air systems including air volumes and control settings under maximum system pressure drop conditions (filter at replacement condition).
- 3.3.3. The Independent Company will measure, make final adjustments and report upon the air volume at each variable volume box, diffusers, register and grille. The static pressure upstream and downstream of the fan, the fan speed and the motor current.
- 3.3.4. Report upon are the air flow at outside, return and exhaust air dampers under conditions of minimum outside air, for maximum and minimum volumes and maximum outside air, exhaust air and return air.
- 3.3.5. Air volumes measured by the Independent Company shall be within plus or minus 5% of those shown on Drawings for diffusers, grilles, registers, variable air volume boxes and fans, at both maximum and minimum volumes shown.
- .1 Duct traverse readings shall be taken through the access ports provided. Where no access ports have been provided new holes shall be made as required. These holes shall be resealed after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable.

- .2 Where insulation is damaged it shall be repaired including the vapour barrier in an approved manner. Duct tape is not acceptable.
- 3.3.6. The Independent Company shall not disconnect any control device. Command control devices and enter adjusted set points into the building automation system with tools and training that are furnished under Section 23 09 00.00 - BUILDING AUTOMATION SYSTEM. If the Independent Company fails to co-ordinate with Section 23 09 00.00 - BUILDING AUTOMATION SYSTEM and if failure to co-ordinate results in any cost, the cost of any change required shall be paid by the Independent Company at no cost to the Owner.
- 3.3.7. In all cases where measurements by the Independent Company show failure to comply with the Drawings and Specifications, the Contractor shall change fan sheaves, etc., as required, and new balancing measurements shall be made by the Independent Company.
- 3.3.8. Ensure all thermostats and controls are set to give specified conditions and include settings is report.
- 3.3.9. For additional information on variable volume boxes refer to Section 23 36 16.00 - VARIABLE VOLUME BOXES.
- 3.3.10. The Independent Company shall witness all system tests and sign all test reports. Include one copy of all test reports in each copy of the balancing reports.
- 3.3.11. Fans on all systems shall be set up to give the minimum discharge pressure required to overcome the resistance of the box, discharge ductwork and diffusers.
- 3.3.12. The Independent Company is responsible for balancing the systems to obtain the design conditions and shall repeat the balancing until the required conditions have been met.
- 3.3.13. At the time of final inspection, recheck in the presence of the Engineer's Representative random selections of air quantities and fan data recorded in the certified report. Points or areas for recheck shall be selected by the Engineer's Representative and be approximately 10% of the report data.
- 3.3.14. At the time of verification measure space temperature and humidity in a representative number of rooms to verify performance. Tabulate these results and bind into certified report as an appendix.
- .1 A measured flow deviation of more than 10% between the verification reading and the reported data shall be considered as failing the verification procedure.
- 3.3.15. Following final acceptance of the certified reports by the Engineer's Representative, permanently mark the settings of all valves, dampers, splitters and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.

END OF SECTION

23 31 13.00
Ductwork and Specialties

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. SUBMITTALS
 - 1.2.1. Shop Drawings
 - .1 Submit Shop Drawings of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.
 - .2 Submit Shop Drawings of each supporting structural assembly required in the ductwork systems, designed by an engineer licensed to practice in the place of work in the appropriate discipline. Same design engineer stamps each and every Shop Drawing.
 - 1.2.2. Samples: Submit samples as required.
 - 1.2.3. Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.
 - .1
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Fabricate all ductwork unless specifically noted otherwise, of galvanized sheet steel with Z180 coating to A653/A653M-98.
 - 2.1.2. Sealing compound: Minnesota Mining and Manufacturing or other approved manufacturer. Duct tape shall be Duro-Dyne or other approved manufacturer.
 - 2.1.3. Flexible ducting:
 - .1 Flexible metal ducting shall be Flexmaster Triple-Lock Aluminum Flexible ducting T/L. ULC listing S110
 - 2.1.4. Access Ports shall be Lawson-Taylor or other approved manufacture of 32 mm (1-1/4 in.) dia. ports.
 - 2.1.5. Flexible Connections:
 - .1 Ventfabrics, Duro Dyne or Dyne-Air.
 - 2.1.6. Dampers:
 - .1 Dampers: For right angle branch duct take-off from vertical riser; Air vector Vectrol or other approved manufacturer.
 - .2 Fire Dampers: Underwriters' Laboratories Classified to ANSI/UL 555 Standard for Fire Dampers and CAN/ULC S112 Standard Method of Fire Test of Fire Damper Assemblies or ANSI/UL 555C Standard for Ceiling Dampers as applicable.

- .1 Fire dampers shall be curtain type, rated as 'Dynamic', and shall have the blades clear of the air stream. Fire dampers shall be Type B or Type C as required to suit system air velocity and pressure. Fire dampers in return and exhaust systems may be Type A with the blades in the air stream where permitted by the Engineer's Representative. Dampers shall be multi-sectional as required to suit size and UL/ULC Listing requirements. Where the specified curtain fire dampers are limited by the UL/ULC Listing for maximum size, they shall be substituted with multi-blade type complete with power actuation and/or fusible link as required to satisfy the fire rating of the partition.
- .2 Fire-stop flaps or ceiling mounted fire dampers shall be as shown in the Underwriters' Laboratories Listing for the specific ceiling assembly used.
- .3 Fabricate manual duct dampers as shown on Standard Details from galvanized steel 1.26 mm thick (0.048 in - 18 GSG gauge) or heavier. Dampers for ducts up to 300 mm (12 in.) deep shall be one blade carried on a 9 mm (3/8 in.) square steel rod mounted inside the duct. Dampers for ducts of greater depth than 300 mm (12 in.) shall be multi-blade, opposed-acting type, and shall have blades mounted in 38 mm (1-1/2 in.) steel channel frame, and interconnected for operation from one locking type hand quadrant. Dampers for right angle take-off of branch from vertical riser shall have operator extended to an accessible location. For externally insulated ducts, mount quadrant on a bracket, designed to clear the insulation. All dampers shall have indicator to show position of damper blade.
- .4 Fabricate splitter dampers as shown on Standard Details from at least the same thickness of galvanized steel as the duct in which it is installed, down to a minimum of 0.95 mm thick (0.0374 in - 20 GSG gauge). Fabricate of double thickness so that the entering edge presents a round nose to the air flow, and mount securely on hinges at the air leaving edge. Length of splitter shall be at least 1-1/2 times the width of the smaller branch duct, but in no case less than 300 mm (12 in.) long. Attach splitter hinge near the air entering edge with support passing through a clamp on the side of the duct, located where it is most accessible for external adjustment and locking of the damper.
- .5 Gravity backdraft dampers shall be multi-blade louver type, constructed of light grade aluminum. Blades shall be joined with a tie bar and have rust-proof shafts rotating in bronze bushings.
- .6 Motorized dampers for Control Operation: In accordance with applicable requirements control systems (pneumatic) or central energy management systems section.
- 2.1.7. Acoustic Insulation: 25 mm (1 in.) thick rigid coated glass fibre.
- 2.1.8. Interior Duct Protective Coating: Chlorinated rubber base paint or Eisenheiss Black.
- 2.1.9. Hardware and Accessories:
 - .1 Spin-in connections shall be specifically built for that purpose. Dampers shall be a minimum 1 gauge heavier than the ductwork in which it is installed and shall have a full length shaft pivoted at two diametrically opposed points. An indicator shall be attached to the shaft to indicate the damper position.
 - .2 Hardware for balancing or splitter dampers shall be rattle-free and leak resistant. Bearing rods shall be sized to suit the damper size. Neoprene seals shall be used to minimize leaks. Hardware shall be Dyn-Air or equal.
 - .3 Turning vanes shall be either double thickness or single thickness with extended leading and trailing edges as specified in ASHRAE and SMACNA Standards. Rails shall be securely set in the elbow so that they cannot loosen. Turning vanes shall be Dyn-Air or equal.
- 2.1.10. Provide following duct penetrations with barred duct inserts to restrict passage for minimum and maximum security applications:

2.2. FABRICATION

- 2.2.1. Fabricate ductwork in accordance with applicable duct construction requirements of SMACNA.

3. Execution

3.1. INSTALLATION

- 3.1.1. Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.
- 3.1.2. Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.
- 3.1.3. Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.
- 3.1.4. Hang all ductwork securely and in a rigid manner. Provide hangers as follows:

TABLE 1: HANGERS

DUCT DIMENSION	HANGER CONSTRUCTION
Horizontal rectangular duct	
Up to 1500 mm (60 in.) for Low Pressure Ductwork Only	Two 25 mm (1 in.) x 16 US gauge straps with two screws on side of duct one screw on bottom. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
For all sizes of Medium and High Pressure Ductwork up to 3000 mm (120 in.) and Low Pressure Ductwork from 1525 mm to 3000 mm (61 in. x 120 in.)	50 mm x 50 mm x 6 mm (2 in. x 2 in. x 1/4 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
Horizontal round duct	
Up to 450 mm (18 in.)	One 25 mm (1 in.) x 16 US gauge hanger ring supported from one 25 mm (1 in.) x 16 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.

- 3.1.5. The following low pressure, medium pressure and high pressure duct construction is based on an ASHRAE method of construction, and gives a minimum standard of construction. Alternative ASHRAE or SMACNA duct construction is acceptable, provided it meets the minimum standards as outlined by these Specifications. Submit proposed alternatives for review prior to fabrication.
- 3.1.6. Construct low pressure rectangular ducts for systems less than 0.5 kPa (2 in.) static pressure and under 10.2 m/s (2000 fpm) velocity as follows:

TABLE 2: LOW PRESSURE DUCT CONSTRUCTION

MAX. DUCT DIMENSION	SHEET METAL US GAUGE	TRANSVERSE JOINT CONNECTION AND BRACING
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing

- .1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.
 - .2 Locate bracings mid-way between joints.
 - .3 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.
- 3.1.7. Medium pressure rectangular ducts are required for all smoke exhaust systems and in the following areas. Construct medium pressure rectangular ducts as follows:

TABLE 3: MEDIUM PRESSURE RECTANGULAR DUCT CONSTRUCTION

MAX. DUCT DIMENSION	SHEET METAL US GAUGE	TRANSVERSE JOINT CONNECTION & BRACING
Up to 300 mm (12 in.)	24	25 mm (1 in.) standing seam, 16 mm (5/8 in.) welded flange 25 mm (1 in.) pocket lock, no bracing.
325 mm to 425 mm (13 in. to 18 in.)	24	25 mm (1 in.) standing seam, 22 mm (7/8 in.) welded flange, 25 mm (1 in.) pocket lock, bracing 25 mm x 25 mm x 16 gauge (1 in. x 1 in. x 16 UG gauge) at 1200 mm (48 in.) centres.

- .1 Bracing spacing shown above is maximum spacing between two bracings or between bracing and joint. Locate bracing mid-way between joints.
 - .2 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.
- 3.1.8. Medium and high pressure round ducts are required in the following areas .
Medium and high pressure round ducts up to 750 mm (30 in.) dia. shall be factory fabricated, helically wound galvanized iron strips with spiral lock seam as follows:

TABLE 4: MEDIUM AND HIGH PRESSURE ROUND DUCT CONSTRUCTION

DIAMETER	STRIP METAL US GAUGE	STRIP JOINT	GIRTH JOINT
Up to 200 mm (8 in.)	26	100 mm (4 in.)	50 mm (2 in.) long slip
225 mm to 550 mm (9 in. to 22 in.)	24	100 mm (4 in.)	50 mm (2 in.) long slip

- 3.1.9. Join with galvanized iron coupling sleeves or conduit fittings of welded construction.

- 3.1.10. Construct larger ductwork as follows with longitudinal lock or butt welded seams:

US GAUGE	SHEET METAL US GAUGE	REINFORCING	GIRTH JOINT
775 mm to 900 mm (31 in. to 36 in.)	20	None	100 mm (4 in.) long slip

- 3.1.11. High pressure rectangular ductwork is required in the following areas .
Construct high pressure rectangular ducts as follows:

Seal all joint of all ducts. Brush joints with the compound before and again after assembly.

- 3.1.12. Seal the bottom and side joints of outside air ducts or plenums water-tight.
- 3.1.13. Flexible duct shall be connected to sheet metal duct and diffusers using duct sealer, minimum of two screws separated by 180 degrees and metal draw bands. Duct tape is not acceptable.
- 3.1.14. Flexible ductwork may be used under the following conditions:
 - .1 Flexible ductwork shall be used where shown to allow easy location of diffusers.
 - .2 Minimum length of flexible duct used to connect diffusers and interior troffers shall be 2,400 mm (84 inches).
 - .3 Maximum length of flexible duct shall be 3,000 mm (120 inches).
 - .4 Flexible ductwork shall not pass through floors or fire walls,
 - .5 Flexible ductwork shall be a single section of duct (no joints). In the event that building construction requires connection between lengths of flexible duct use a rigid section of duct as the joint. Flexible duct shall be secure to the rigid section using ties and sealant.
 - .6 Flexible duct lengths greater than 2,400 mm (84 inches) shall be supported at the midpoint with strap hangers.
- 3.1.15. Where ductwork passes through a wall or floor, other than when a fire damper is required, pack around the duct using a fire resistant material to ensure a sound and airtight joint.
- 3.1.16. If changes of size of ducts are necessary because of building construction, maintain the same circular equivalent for the new size. Ratio of the longest side of the duct to the least shall not exceed 4 to 1 unless specifically authorized by the Engineer's Representative.
- 3.1.17. Select the gauge of metal and method of construction for the new size. Notify the Engineer's Representative of any change before such changes are incorporated into the work.
- 3.1.18. If changes of location of duct, are required because of building construction, review with the Engineer's Representative before the locations indicated are changed in any way.
- 3.1.19. Make changes of direction of horizontal ducts with elbows having an inside radius not less than 3/4 the width of the duct. Make change of direction from horizontal to vertical duct with elbows having an inside radius equal to the depth of the duct. Where this is not possible due to the building construction, use turning vanes.
- 3.1.20. Provide access ports at convenient locations in all main ducts and main branch take-offs with airtight covers and extension sleeves through insulation to allow air meter readings. Access ports shall be approved by the Engineer's Representative and the testing company before installation.
- 3.1.21. Provide flexible connections at each air handling unit and fan duct connection.
- 3.1.22. Install manual duct dampers as shown on Standard Details. Ensure dampers for right angle take-off of branch from vertical riser have operator extended to an accessible location. Adjust quadrants to clear duct insulation.
- 3.1.23. Provide splitter dampers as shown on Standard Details.
- 3.1.24. Incorporate gravity backdraft dampers where shown.

- 3.1.25. Install fire dampers where shown and at all penetrations through all fire rated assemblies. Where fire dampers are shown in grilles or diffusers at ceiling level they shall be firestop flap. Obtain local authorities approvals for all damper locations and keep one set of marked-up prints on site. Approvals shall be obtained before installation of fire dampers.
- 3.1.26. Where fire dampers for ducts shown on Drawings require a change of type and/or powered actuation due to dimension limitations to satisfy the cUL Classification requirements, provide transitions as required to adjust duct dimensions while maintaining the equivalent circular duct diameter to avoid exceeding any specific listed maximum dimension. Where transitions are not possible or dimensions cannot be adjusted to avoid powered actuation, provide power from the closest available emergency power source as required. Review all conditions with the Engineer's Representative in advance of fabrication.
- 3.1.27. Receive automatic dampers from separate Section on site, and set in place under the supervision of the control manufacturer.
- 3.1.28. Provide access panels at all fire dampers, gravity dampers, motorized dampers, coils, heaters, humidifiers, fan bearings or similar equipment requiring occasional maintenance or inspection. Panels shall be 600 mm x 450 mm (24 in. x 18 in.) or full width of duct if less than 450 mm (18 in.) wide. Panels shall be of double wall construction and shall be internally insulated on insulated ducts. Frame shall be of structural angle with welded corners, gasketed to receive the panel. Panel shall be held in place with 4 window sash locks.
- 3.1.29. Paint visible internal surface behind each grille or register flat black.
- 3.1.30. Where duct is acoustically lined, duct dimensions shown are net, inside of lining.
- 3.1.31. Apply acoustic insulation internally to ductwork where shown. In addition, internally line all low or medium pressure supply air ductwork in mechanical rooms, fan rooms, or equipment rooms. For acoustic lining downstream of VAV boxes refer to Section 23 36 16.00 - VARIABLE VOLUME BOXES. Install using both pins and adhesive. Pins shall be maximum 450 mm (18 in.) centres and shall be tack welded to the duct or plenum. Seal all edges of acoustic insulation to prevent air erosion with sheet metal nosing that overlaps the insulation by 19 mm (3/4 in.) minimum.
- 3.1.32. Spin-in connections shall only be used downstream of variable volume boxes.
- 3.1.33. Ductwork shall be run parallel to the closest wall. Coordinate with piping and structural elements.
- 3.1.34. All open ends of ductwork that do not have a diffuser, grille or register shall have a protective screen mounted in a suitable frame to connect the screen securely to the duct, wall and floor as applicable. Where a duct terminates at a supply, return or exhaust air opening provided by other sections and located less than 2000mm (79 in.) Above the finished floor, the screen shall be installed and painted matte black and shall not be capable of passage of anything larger than a 15mm (1/2 in.) Sphere through the openings.
- 3.1.35. Supply air ductwork to variable volume boxes shall be rigid duct of size shown in schedules. If the length exceeds 3000 mm (10 ft.) or if there are 2-45 deg. elbows or 1-90 deg. elbow or more increase in supply air ductwork to the variable volume box one size. If the length exceeds 6000 mm (20 ft.) increase the duct by two sizes. Under no conditions shall be supply ductwork exceed 9000 mm (30 ft.) or have more than 3-90 deg. elbows or the equivalent.

END OF SECTION

23 34 53.00 Room Ventilators

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. SUBMITTALS
 - 1.2.1. Shop Drawings:
 - .1 Submit Shop Drawings of all room ventilators with catalogued components to be supplied. Include manufacturer's data sheets for, performance criteria, ratings, and physical dimensions and finishes.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Room ventilators shall be Penn Zephyr, Greenheck, Loren Cook Gemini, Soler & Palau or Twin City.
 - 2.1.2. Centrifugal fans shall be mounted in a galvanized steel, acoustically insulated housing and shall be internally isolated. Fans shall be AMCA certified for both air and sound, UL labelled and CSA approved.
 - 2.1.3. Arrange casing for in-line installation with access to both fan and motor through the casing.
 - 2.1.4. Inlet and discharge shall be flanged for duct connections.
 - 2.1.5. Discharge shall be complete with spring loaded backdraft damper.
 - 2.1.6. Motors shall be prewired to terminal box located on the unit housing.
 - 2.1.7. Motors shall be 120 volts, 1 phase.
 - 2.1.8. Speed control shall be Lek-Trol variable speed/off, solid state controller.
 - 2.1.9. All intake and discharge ductwork shall have 25 mm (1 in.) thick acoustic lining.
 - 2.1.10. Room ventilators shall be in accordance as per below:
EF-2.1 – Greenheck CSP-200, 200CFM, 0.5 in.wg., 120V/1Ph/60Hz. Complete with reverse acting thermostat.
3. Execution
 - 3.1. INSTALLATION
 - 3.1.1. Install room ventilators where shown.
 - 3.1.2. All ventilators on vibration isolation hangers shall have flexible connections on both inlet and outlet.
 - 3.1.3. Speed control switch to be supplied only. Electrical Division to include for wall mounting and wiring.

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Section 23 34 53.00 Room

Ventilators

Ductwork and Specialties

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- 3.1.4. Where reverse acting thermostats are specified in the Drawings, thermostat to be supplied by the Mechanical Division, Electrical Division to include for wall mounted and wiring.

END OF SECTION

23 37 13.00
Diffusers, Grilles and Registers

1. General
 - 1.1. WORK INCLUDED
 - 1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
 - 1.2. RELATED WORK SPECIFIED ELSEWHERE
 - 1.2.1. None.
 - 1.3. SUBMITTALS
 - 1.3.1. Shop Drawings: Submit detailed Shop Drawings of all components furnished under this Section. Manufacturer to indicate ceiling installation type for each type of diffuser specified.
 - 1.3.2. Manufacturer's Data: Submit test results of type " "diffuser models to be used on the project, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow.
2. Products
 - 2.1. MATERIALS
 - 2.1.1. Diffusers, registers and grilles shall be EH Price.
 - 2.1.2. Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1800 mm (6 ft.) above the floor shall be 0.127 to 0.254 m/s (25 to 50 fpm).
 - 2.1.3. Noise generated by diffusers shall be such that room sound pressure level does not exceed noise criteria 32 with an 8 db room attenuation, the sound power level reference to 10 to -12 power watts.
 - 2.1.4. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille.
 - 2.1.5. In T-bar ceilings, manufacturer shall coordinate diffuser compatibility with t-bar ceiling specified by the architectural division. Colour shall match colour of ceiling tile in lay-in ceilings. Diffusers to suit ceiling grid as required imperial or metric.
 - 2.1.6. Diffusers shall meet test requirements of A.S.H.R.A.E. Standard 36B-63, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63 and NC ratings shall be determined using an 8 db room attenuation factor

2.2. SQUARE SUPPLY DIFFUSERS

- 2.2.1. All diffusers shown as type "P" shall be steel square plaque diffuser 600 mm x 600 mm (24 in. x 24 in.) face size and shall be square, coned metal. Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown. An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck. E.H. Price SPD.

2.3. LINEAR SUPPLY AND RETURN DIFFUSERS

- 2.3.1. All diffusers shown as type "T1" shall be T-bar plug-in, 1 slot diffuser modified with square ends to limit side spread, and of lengths shown. Diffuser shall be installed with manufacturer plenum to match the length of the diffuser shown. Provide diffuser with mounting clips to suit in continuous T-bar openings. Pattern controllers shall be split mid length to allow each half of diffuser shall be set for different throw patterns. Throw patterns shall be fully adjustable from vertical to horizontal and variations in between. Provide blank-off panels between diffusers. Pattern controllers and blank-off panels shall be finished matte black. Plenum shall be fabricated from coated steel. Refer to Architectural Details for installation of continuous supply air slot. Duct connection to diffuser shall be of sufficient height to allow for 175 mm (7 in.) clearance from ceiling to underside of duct. EH-Price TBD3 series, Nailor 5800, Krueger PTBA, Carnes DASC.

2.4. RETURN, EXHAUST AND TRANSFER GRILLES

- 2.4.1. Return grilles shown as type "E" shall be size as shown and shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick. Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system. Colour shall match adjacent ceiling tiles. E.H. Price Series 80, Nailor 5100 Series, Krueger EGC5 Series, Carnes RPAH.
- 2.4.2. Return registers shown as type "K" shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return. Key operated damper shall be mounted behind. General appearance, type of material and finish shall match the type "..." supply register. E.H. Price 530, Nailor 6100 Series, Krueger S80, Carnes model RSBAH.
- 2.4.3. Return registers shown as type "S" shall be linear slot return diffuser E.H. Price SDR150.

3. Execution

3.1. INSTALLATION

- 3.1.1. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit these drawings. The mechanical drawings show intent and number of diffusers, grilles and registers required.

- 3.1.2. Provide transfer grilles in all finished spaces where air is transferred through a ceiling or partition.
- 3.1.3. For exposed ductwork installations, all connections to grilles shall be oversized and shall have in-turned flanges to meet the flange of the grilles and the duct. Out-turned or exposed flanges with screw mounting shall not be accepted.
- 3.1.4. For special mounting of diffusers, grilles and registers refer to Architectural Drawings.
- 3.1.5. Where rigid duct is connected to the diffuser, grille or register all devices used for flow pattern adjustment, flow balancing and flow equalizing shall be accessible from the face of the diffuser.
- 3.1.6. Install mounting frame tied into plaster and gypsum board ceilings to allow lay in type diffusers to rest on the frame.
- 3.1.7. Diffusers for installation in lay-in ceiling shall lay on inverted T-bars.
- 3.1.8. Contractor shall be responsible for mounting concealed flange linear diffusers in heated environment and following manufacturers' instructions.
- 3.1.9. Contractor shall caulk around edges of linear diffusers in installations with imperfect walls.

END OF SECTION

23 83 00.14 Electric Radiation Heaters

4. General

4.1. WORK INCLUDED

4.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

5. Products

5.1. MATERIALS

5.1.1. Provide Electric Baseboard Heaters:

- .1 0.9525 mm thick (0.0375 in. – 20 MSG) steel, factory standard white powder painted, complete with end caps.
- .2 Built-in thermostat and controls, unless otherwise indicated on Drawings.
- .3 Acceptable manufacturers are Ouellet, Reznor, Dimplex, Stelpro, Chromalox or Indeeco.

5.1.2. Provide Electric Baseboard Heaters with capacities as shown on Drawings.

5.1.3. Provide Electric Baseboard Heaters with a single 120/1/60 electrical connection that powers all components including but not limited to:

- .1 Control panel
- .2 Safeties

6. Execution

6.1. INSTALLATION

6.1.1. Install in accordance with manufacturer's current installation guidelines.

END OF SECTION