Senior Services and Long-Term Care
City Of Toronto

CUMMER LODGE
ROOF AND ROOFTOP DUCKWORK INSULATION
REPAIR AND REPLACEMENT 2024

PROJECT MANUAL
VOLUME 2
(2 OF 2)

ISSUED FOR TENDER
May 2024

ISSUED FOR MLTC REVIEW
May 2024

MSA PROJECT NO: 21504.F04

MONTGOMERY SISAM ARCHITECTS INC. ARCHITECTURAL
CROSSEY ENGINEERING LTD. MECHANICAL

NO	2

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification is an integral part of the Contract Documents and shall be read accordingly.

1.1.2 The General Conditions of the Contract, the Supplementary Conditions and all Sections of Division 0 and 1 - General Requirements shall be deemed to apply and be a part of this section of the specification as fully as if recited in full herein.

1.1.3 Definition

.1 Mechanical Contractor: The term “Mechanical Contractor” is used within this specification when referring to the Division 21, 22 and 23 Contractor.

1.1.4 All portions of the Supplementary Bid Form - Mechanical shall be submitted by bidders on this Division of the Work.

1.2 PREQUALIFIED SUB CONTRACTORS TO THE MECHANICAL CONTRACTOR

1.2.1 Where identified, pre-qualified subcontractors have been named for specific sub contracts. When so identified, the bid from the Mechanical Contractor shall include one of the pre-qualified contractors, and the name of the selected Contractor shall be included in the Mechanical Supplementary Tender Form.

1.2.2 Contractors for the trades identified and not included on the pre-qualified list may be named in the Mechanical Supplementary Tender Form as an alternate supplier, with a cost savings. The Owner will decide to accept or reject the proposed alternate. Under no circumstances should the Mechanical Contractor carry any Alternate Price in his base bid.

1.2.3 Carrying an Alternate Contractor or Alternate Supplier in the base bid submitted on the Supplementary Tender Form will result in the bid being disqualified.

1.3 INTENT

1.3.1 Bidders for work under this Division shall include for all labor, material, equipment and all other related cost including all applicable taxes and fees to provide the complete mechanical work specified in Division 21, 22, 23 and 25 and shown on the mechanical drawings, and all mechanical work noted in the specifications and shown on the drawings for other Divisions of this Contract as being the responsibility of the Mechanical Contractor.

1.3.2 Misinterpretation of any requirement of the drawings and specifications will not relieve the Mechanical Subcontractor of responsibility to complete the specified work. If in any doubt, the Subcontractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.

1.3.3 The Mechanical Contractor shall assume full responsibility for the entire mechanical installation noted in the specifications and drawings. Demarcation of the responsibilities among various mechanical sub trades shall be the sole responsibility of the Mechanical Contractor.

1.3.4 DIVISION 1 REFERENCE

.1 The following Division 1 Specification Sections are referenced in the Division 21, 22, 23 and 25 Specifications:

.1 Amendments to CCDC 2 – 1994.

.2 Section 01 21 00 – “Allowances”.

.3 Section 00 21 13 – “Instruction to Bidders”.

.4 Section 01 23 10 – “Alternatives”.

.5 Section 01 29 00 – “Payment Procedures”.

.6 Section 01 31 00 – “Project Management and Coordination”.

.7 Section 01 31 16 – “Construction Progress Schedule”.

.8 Section 01 31 19 – “Project Meetings”.

.9 Section 01 33 00 – “Submittal Procedures.

.10 Section 01 35 21 – “LEED” Procedures.

.11 Section 01 35 29 – “Health and Safety Procedures”.

.12 Section 01 35 73 – “Procedures for Demolition of Structures”

.13 Section 01 45 00 – “Quality Control”.

.14 Section 01 51 00 – “Temporary Facilities”.

.15 Section 01 52 00 – “Construction Facilities”.

.16 Section 01 61 00 – “Common Product Requirements”.

.17 Section 01 74 11 – “Cleaning”.

.18 Section 01 74 21 – “Construction Demolition/Waste Management and Disposal”.

.19 Section 01 77 00 – “Close Out Procedures”.

.20 Section 01 78 00 – “Close Out Submittals”.

.21 Section 01 79 00 – “Demonstration and Training”.

.22 Section 01 91 13 – “General Commissioning Requirements”.

.23 Section 01 91 31 “Commissioning Plan”.

.24 Section 07 62 00 “Sheet Metal Flashing and Trim”.

.25 Section 07 92 00 “Joint Sealants”

1.4 INTERFERENCE

1.4.1 Provide information and cooperate with the Construction Manager/General Contractor for the preparation of interference drawings.

1.4.2 Interference drawings shall be prepared in the following format:

.1 Autocad 2023.

1.4.3 These drawings shall be submitted to the Consultant for review on both a hard copy and electronic format. For projects where the interference drawings are being prepared in Revit the Revit model shall be made available on a biweekly basis to the Consultant for review.

1.4.4 Interference drawings shall be provided to make clear the work intended or to show how it affects other trades.

1.4.5 Interference drawings shall be provided to scale 1:100 for the following spaces:

.1 Roof.

1.4.6 Interference drawings shall also be provided for areas where there are potential conflicts in positioning the mechanical and electrical equipment, piping and cable trays/conduits.

1.4.7 Coordinate with all other trades and divisions before interference drawings are prepared. Installed and/or fabricated services shall be modified, replaced, removed and/or relocated to suit the field conditions at no extra cost to the Owner due to the lack of coordination prior to fabrication/installation.

1.4.8 For equipment substitutions a complete interference drawing of the area affected by the revision shall be provided by the Mechanical Contractor.

1.4.9 Interference drawings shall be provided showing both plan and sections and shall incorporate all services including ductwork, HVAC piping, plumbing and drainage, electrical conduit over 3" (75mm) and electrical cable trays.

1.4.10 Dimensioned drawings shall be provided for all roof penetrations for review by the Mechanical Consultant.

1.4.11 Installation of the work provided by the Mechanical Contractor shall not proceed until final interference drawings have been submitted.

1.5 CONTRACT

1.5.1 The mechanical drawings do not show all the Architectural and structural details, and any Specifications information involving accurate measuring of the building shall be taken from the building drawings or at the building. Make without additional charge, any necessary changes or additions to the runs of drains, pipes, ducts, etc., to accommodate the above conditions. The location of equipment may be altered without charge providing the change is made before installation and does not necessitate major additional material. The Architectural, Structural, and Electrical drawings may show

details relevant to the mechanical systems and should be referred to equally with the Mechanical drawings.

1.5.2 Wherever differences occur between plans and riser diagrams or schematics and drawings, the maximum conditions shall govern and the bid shall be based on whichever indicates the greater cost.

1.5.3 Field verifications of dimensions on plans shall be made since actual locations, distances, and levels will be governed by actual field conditions.

1.5.4 Discrepancies between different plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Consultant for a decision.

.1 As the work progresses and before installing apparatus, equipment, fixtures and devices which may interfere with the interior treatment and use of the building or with the work of other trades, provide interference drawings and consult with the Consultant for instructions for the exact locations of all drains, pipes, ducts, and equipment. Refer to Division 1 specification Section 01 31 00 – “Project Management and Coordination”.

1.5.5 and provide information and interference drawings as may be required by this Section.

1.5.6 Install all mechanical services including but not exclusive to drains, pipes, and ducts, to conserve headroom and interfere as little as possible with the free use of the space through which they pass. All drains, pipes, ducts, etc., particularly those which may interfere with the inside treatment of the building, or conflicting with other trades, shall be installed only after the locations have been approved by the Consultant. Special care shall be taken in the installation of all mechanical services including, but not exclusive to drains, pipes, and ducts, which are to be concealed to see that they come within the finished lines of floors, walls, and ceilings. Where such drains, pipes, ducts, etc., have been installed in such a manner as to cause interference, they shall be removed and re-installed in suitable locations without extra cost to the owner.

1.5.7 Before commencing work, check and verify all grade and invert elevations, levels, and dimensions, to ensure proper and correct installation of the work.

1.5.8 In every place where there is space indicated as reserved for future or other equipment, leave such space clear, install blank offs, shut off valves with blind flanges and other work so that the necessary connections can be made without any stoppages to the system. Consult with the consultant whenever necessary for this purpose.

1.5.9 In addition to the work specifically mentioned in the specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the authorities having jurisdiction over the work.

1.5.10 The mechanical plans show approximate locations for roof mounted devices. Obtain Consultant's approval of mounting heights and locations before commencement of work.

1.5.11 The Mechanical Contractor shall provide a list of the foreman for each trade who will be involved with this project prior to the start of construction. The list is to contain their credentials and a list of previous projects that they have been involved with.

1.5.12 The Mechanical Contractor is responsible for coordinating the installation of the mechanical services on the roof. Provide coordination/interference drawings prior to installation of the services in accordance with item 1.5 of this section of the specification and include in the Mechanical bid price the cost of all minor offsets of ductwork, piping, etc. to coordinate the installation of the services.

1.6 EXAMINE SITE

1.6.1 Examine the site and the local conditions and Conditions affecting the work. Examine carefully the Mechanical drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown. Before commencing work, examine the work and report at once any defect or interference affecting the work, the completion, or the guarantee of the work of this Division. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Consultant.

1.7 PROGRESS PAYMENTS

1.7.1 Refer to Section 22 05 03.

1.8 CONTRACTOR'S SHOP

1.8.1 Provide Job site office, work-shop, tools, scaffolds, material storage, etc., as required to complete the work of the Mechanical Contractor.

1.9 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 – “Submittal Procedures.

1.9.2 Shop drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

1.9.3 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 “ Close Out Submittals” Section 01 78 00 – “Close Out Submittals”.

.2

.3 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.2 Refer to Section 22 05 02 – Maintenance and Operation Manuals

.3 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant

.2 Make changes as required and re-submit as directed by Consultant.

.4 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.5 Site records:

.1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.6 Record drawings:

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

.2 Submit to Consultant for approval and make corrections as directed.

.3 The Mechanical Contractor shall incorporate the As Built information into the electronic file specified above and submit the updated drawings to the Consultant.

.4 Submit the as-built drawings with Operating and Maintenance Manuals.

.5 Record, as the job progresses, all approved changes and deviations made to any work shown on the original contract drawings whether by addenda, requested changes, field instructions, and changes due to job conditions.

.6 Record drawings shall be kept up to date and available for review at any time by the Consultant. Progress draws may not be processed if record drawings are not kept up to date.

1.10 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 – “Quality Control”.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 – “Health and Safety Procedures”.

1.11 DELIVERY, STORAGE, AND HANDLING

1.11.1 Waste Management and Disposal:

.1 Dispose of waste as directed by the Front End Documents prepared by the Construction Manager / General Contractor.

1.12 INSTALLATION OF WORK

1.12.1 Be responsible for:

1.12.2 The layout of the work of the Mechanical Contractor and for any damage caused to the Owner, or other Divisions of the contract by improper location or carrying out of this work.

1.12.3 The protection of finished and unfinished work and equipment and work of other Divisions from damage due to the carrying out of the work of the Mechanical Contractor.

1.12.4 The condition of all material and equipment supplied under the Mechanical Contract, and for the protection and maintenance of work completed.

.1 Coordinate with schedule all work to suit the date for the substantial performance established in the construction contract. Refer to Section 01 31 00 – “Project Management and Coordination”.

1.12.5 Furnish items to be "built-up" in ample time and give necessary information and assistance in connection with the building in of the same.

1.12.6 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule. Ensure that all health, safety and environmental conditions are maintained.

1.12.7 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.

1.12.8 Furnish promptly information required for the construction schedule.

1.12.9 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

1.13 CODES, PERMITS, FEES AND CONNECTIONS

1.13.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By-Laws and Regulations in force in area where the building is to be erected.

1.13.2 Apply for, obtain, and pay for permits, fees and service connections for the work of this Division and the inspections required by Authorities having jurisdiction in the area where the building is to be erected.

1.13.3 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

1.13.4 When part of equipment does not bear the required UL label, the contractor shall obtain UL approval on site, when that part of the equipment is an electric component, a special approval shall be obtained and the Contractor shall pay the applicable fees.

1.13.5 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

1.14 MATERIALS

1.14.1 Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish standards of desired quality style or dimensions and shall be the basis of the Bid. Materials so specified shall be furnished under this Contract, unless changed by mutual agreement. Where two or more designations are listed, the contractor shall choose one of those listed and state the choice made on the "Supplementary Bid Form-Mechanical".

1.14.2 The use of equivalent, alternate and/or substitute materials and equipment is subject to the following:

1.14.3 Where the use of equivalent, alternate or substitute equipment alters the design or space requirements indicated on the plans, the contractor for Division 15 shall include all items of cost for the revised design and construction, including cost of all the related trades involved.

1.14.4 Acceptance of the proposed equivalents, alternates or substitutions shall be subject to the approval of the Consultant and, if requested by the Consultant, the Mechanical Subcontractor shall submit samples of both the specified and the proposed items for review.

1.14.5 In all cases where the use of equivalents, alternates or substitutions is permitted, the Mechanical Subcontractor shall bear any extra costs of independent testing agencies of evaluating the quality of materials and the equipment to be installed.

1.15 EQUIVALENTS AND ALTERNATES

1.15.1 Should the base Mechanical Subcontractor propose to furnish material and equipment other than those specified, he shall apply in writing to the Consultant for approval of equivalents at least fourteen days prior to opening of Bids, submitting with his request for approval complete descriptive and technical data on the item or items he proposes to furnish. Approval for changes in base bid specifications will be considered only upon

individual requests of the Subcontractors. No blanket approval for equipment will be given to suppliers, distributors or contractors.

1.15.2 Unless requests for changes in base bid specifications are received and approved prior to the opening of the bids, as defined above, the Subcontractors will be held to furnish specified items under his base bid. After the Contract is awarded changes in specifications will be made only as defined in Article: Material Substitutions (22 05 01 – Item 1.18)

1.15.3 Equipment of the Subcontractors' choice may be offered as alternates to the items named in the specifications, in the space provided in the Supplementary Bid Form. Alternate proposals must be accompanied by full descriptive and technical data on the article proposed, together with a statement of the amount of addition or deduction from the base bid if the alternate is accepted. Prior approval from the Consultant is not required on items submitted as alternate bids, but the decision on acceptance of the alternate(s) will rest with the Consultant.

1.15.4 Unspecified materials and/or rejected alternates built into the work shall be replaced with specified or accepted materials at no additional cost to the Owner.

1.16 MATERIAL SUBSTITUTIONS

.1 After execution of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be approved by the Consultant as specified in Section 01 23 10 – “Alternatives”.

1.17 SHOP DRAWINGS AND SAMPLES

1.17.1 Submit to the Consultant detailed dimension shop drawings and installation wiring diagrams for all mechanical equipment. Further details and special requirements called for in these specifications shall be shown on the shop drawings.

1.17.2 All 8 ½” x 11” and 11” x 17” shop drawings shall be submitted in electronic format. The procedure shall be as follows:

1.17.3 Shop drawings are to be sent through the proper channels in electronic PDF format.

1.17.4 Each submission of shop drawings shall include a completed Shop Drawing Transmittal form filled out in its entirety. The shop drawings submittal template included in the appendix to this section of the specification shall be utilized.

1.17.5 The Shop Drawing Transmittal sheet must identify the relevant Mechanical or Electrical Project Manager at Crossey Engineering that the shop drawings are being sent to.

1.17.6 Crossey Engineering will return one electronic copy of the shop drawings through the proper channels for the project. All printing costs associated with printing hard copies of the shop drawings shall be the responsibility of the Contractor.

1.17.7 All shop drawing submittals that are larger than 275mm x 425 mm (11” x 17”) shall be submitted in either hard copy or electronic format as agreed to by Crossey Engineering’s designated Project Manager.

1.17.8 Ensure that one hard copy of all reviewed shop drawings are available on the job site for reference.

.1 Provide samples of mechanical equipment as requested in the specification in accordance with Section 01 33 00 – "Submittal Procedures.

1.17.9 Failure to provide this information with the shop drawing will result in the shop drawing being rejected for resubmittal.

1.18 TEMPORARY AND TRIAL USAGE

1.18.1 After any part of the work for Mechanical Contract has been completed, the Consultant will make an inspection, and performance tests of such parts shall be carried out under the direction of the Consultant. If deficiencies are found, they shall be immediately rectified to the satisfaction of the Consultant. After such deficiencies have been rectified, the work shall be placed in service at such time and in such order as the Consultant may direct. If, in placing a portion of the equipment in service, it is necessary to make temporary connections in the wiring in order to obtain proper operation, such connections shall be provided to the extent and in the manner required by the Consultant.

1.18.2 Temporary or trial usage of any mechanical devices, machinery, apparatus, equipment or materials shall not be construed as evidence of the acceptance of same.

1.18.3 No claims for damage will be considered for damage to, or the breaking of any parts of such work which may be used.

1.19 CONSULTANT'S INSTRUCTIONS

1.19.1 During construction the Consultant will issue such instructions as may be necessary for verification and correction of the work. These instructions shall be binding as part of the specification.

1.20 ADDITIONAL WORK AND CHANGES

1.20.1 Refer to Division 0 Amendments to CCDC 2 – 1994 of the specification for the procedures to be followed and the mark ups for Overhead and Profit that will be accepted for additional work and changes.

1.21 WARRANTY

.1 Refer to Section 01 77 00 – "Close Out Procedures".

1.21.2 this section of the specification.

1.21.3 The Mechanical Contractor shall provide a warranty for all work and apparatus installed under his contract against all defects of workmanship and material for a period of one year after the substantial performance of the work, unless otherwise mentioned in the specifications, and shall make good any and all defects developing during such time without expense to the Owner. Any materials shall be further guaranteed as may be called for in these specifications. Where warranties on equipment extend beyond one (1) year the Contractor for Division 15 shall honor the extended warranty.

1.22 SCHEDULING OF WORK

1.22.1 For all work to be performed under this contract, adhere to construction schedule detailed in other parts of the contract, and/or as prepared by the Construction Manager.

1.22.2 Provide schedule information in accordance with section 22 05 06.

1.22.3 All connections to the services serving existing buildings that remain operational shall be coordinated with the Owner a minimum of two weeks prior to any shut down.

1.23 SCHEDULING OF SHOP DRAWINGS

1.23.1 Mechanical Contractor shall submit a detailed shop drawing schedule as indicated in Section 22 05 06.

1.24 BONDS AND CASH ALLOWANCES

.1 Refer to Section 00 21 13 – “Instruction to Bidders”.

.2 Section 01 21 00 – “Allowances”.

1.24.2 details of Bonding requirements and Cash Allowances.

1.25 TESTS

1.25.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

1.25.2 Inform the Consultant when tests will be conducted. The Consultant will periodically be present for tests. All tests are to be documented test results submitted and included in the maintenance manuals. Refer to attached Appendix A for the format to be utilized for the test reports.

1.25.3 Bear costs including retesting and making good.

1.26 PAINTING

1.26.1 Apply at least one coat of corrosion resistant primer paint to all existing duct supports.

1.26.2 Touch-up paint all damaged equipment with products matching original finish in quality and appearance.

1.27 INSTRUCTION OF OPERATING STAFF

1.27.1 Supply certified personnel to instruct operating staff on operation of mechanical equipment. Supply maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

1.27.2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

1.27.3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn manuals over to the Consultant.

1.27.4 Scheduling of the timing for the training of the operating staff shall be arranged 45 days prior to the completion of the project.

1.28 MAINTENANCE MANUALS

1.28.1 Refer to Section 22 05 02.

1.29 FLASHING

1.29.1 Coordinate with requirements for roofing, water-proofing and flashing in Section 07 62 00 “Sheet Metal Flashing and Trim”

1.29.2 Flash mechanical parts passing through, or built into a roof. Leave flashing as directed by the Roofing Trade to permit Roofing Trade to make a watertight connection.

1.29.3 Provide zinc coated steel flashing in accordance with Section 07 62 00 “Sheet Metal Flashing and Trim” pipes and ducts passing through waterproof floors.

1.29.4 Co-operate with Division 7 at all times, and do not break any waterproofing seal without consent of the Waterproofing Trade. Provide piping passing through waterproof walls with extra heavy cast iron sleeves with asphalt roofing wrapped around so as to leave a 1" x 2" (25 mm x 50 mm) recessed on both sides of wall. These recesses and the space between pipe and sleeve shall be caulked as specified in Section 07 92 00 “Joint Sealants”.

1.29.5 Fit counter flashing over flashing or curb, and make watertight.

1.29.6 Detailed dimensioned drawings showing all roof penetrations shall be submitted to the Structural Consultant for review.

1.30 CURBS AND SLEEPERS

1.30.1 Prefabricated curbs for mechanical equipment will be provided by the Mechanical Contractor. Built-up curbs and sleepers will be supplied and installed under work of other sections, except as specified herein and noted on the drawings.

1.30.2 It shall be the responsibility of the Mechanical Trade to supply detailed requirements for curbs, including their locations, sizes and materials to be used, and loads imposed on the curbs.

1.30.3 Curbs are required for roof mounted equipment, surrounding holes where groups of pipes and/or ducts pass through equipment room floors, and where indicated on the Drawings.

1.30.4 Roof curbs shall be minimum 12" (300 mm) height above finished roof.

1.30.5 Curbs around holes in equipment room floors shall be concrete or steel, extending at least 6" (150 mm) above finished floor. Make watertight connection between curb and floor.

1.30.6 Fill spaces between curbs and pipes and ducts with glass fibre material. Caulk with fire resistant waterproof compound to make watertight connection.

1.30.7 Sleepers shall be provided for the equipment installed outdoor without a roof curb. Sleepers shall be constructed of pressure treated lumber and shall be covered by 18-gauge steel cladding, primed and painted unless otherwise noted on the drawings.

1.31 METALS

1.31.1 Steel construction required solely for the work of Mechanical Subcontractor and not shown on Architectural or Structural Drawings shall be supplied and installed by this Subcontractor in accordance with applicable requirements of Division 05, Metals, Structural and Miscellaneous.

1.32 CUTTING AND PATCHING

1.32.1 No cutting and patching is anticipated in this project. If required the Contractor shall abide by the following

1.32.2 Cutting and patching shall be in accordance with General and Supplementary Conditions and the following:

1.32.3 No openings shall be permitted through the completed structure without the written approval of the Architect. Any openings which are required through the completed structure must be clearly and accurately shown on a copy of the structural drawings. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Architect for review, well in advance of doing the work.

1.32.4 All cutting and patching shall be done by the trades specializing in the materials to be cut and is covered by the appropriate Divisions of this specification. Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure and all insert sizes and locations. Where this information is not furnished in time, the Subtrade contractor for this Division shall bear the cost of all sleeving, provision for inserts, cutting and patching.

1.32.5 Should any cutting and/or repairing of finished surfaces be required, the Subtrade contractor for this Division shall employ the particular trades engaged on the site for this type of work to do such cutting and/or repairing. Obtain the approval of the Consultant before doing any cutting. In the event that tradesmen required for particular cutting and/or repairing are not already on the site, bring to the site tradesmen to do this work.

1.32.6 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Consultant in writing.

1.32.7 Prior to cutting any existing walls and floors the Division 21, 22 and 23 Contractor shall consult with the Structural Engineer for approval. Where X-rays are requested by the Structural Engineer the Division 21, 22 and 23 Contractor shall provide x-rays at no cost to the Owner. All X-raying shall be done during off hours.

1.33 PERFORMANCE TESTS

.1 Refer to Section 01 77 00 – “Close Out Procedures”.

1.33.2 performance test requirements.

1.33.3 In addition, provide all labour to complete the requirements outlined in Section 01 91 31 “Commissioning Plan”.

1.34 MECHANICAL PROJECT COMPLETION

.1 Refer to Section 01 77 00 – “Close Out Procedures”.

1.34.2 the requirements outlined in this section.

1.34.3 Thirty days prior to substantial performance of work obtain documentation and/or prepare certification of the following times and submit them to the Owner's representative:

.1 All inspection certificates.

.2 Warranty certificates as called for under "Warranty".

.3 Record drawings.

.4 Operating and Maintenance Manuals.

.5 Test certifications as called for under "Testing". All test certificates to be included in maintenance manuals.

.6 Provide a signed statement to the effect that all tests for mechanical systems and equipment have been completely carried out in the Trade Sections of these Specifications and to the manufacturer's recommendations, and in accordance with the requirements of all authorities having jurisdiction.

1.35 WORK WITHIN THE EXISTING BUILDING

1.35.1 Refer to Division 22 Section 22 05 08 for the requirements for work within existing buildings.

1.36 REQUESTS FOR INFORMATION - RFI

1.36.1 The successful Contractor may submit if he chooses, a Request for Information also known as an RFI to the Consultant Team for clarification to an item within his Scope of Work.

1.36.2 It is understood that an RFI is a form of dialogue between the Contractor and Consultant(s).

1.36.3 In order to expedite the RFI response time, the RFI must be clearly identified and directed to the Consultant responsible for that work.

1.36.4 All RFI’s that involve a site interference issue shall include the Contractor’s proposed solution to the interference.

1.36.5 RFI’s must be submitted in a timely manner. The Contractor shall never place the Consultant’s in a situation where, due to poor planning by the Contractor an RFI

requires an immediate response by the Consultant in order to avoid a delivery date being put in jeopardy.

1.36.6 The Contractor shall submit all RFI's in a timely manner to ensure that the Construction Schedule is not impacted.

1.36.7 All RFI's that are received after 1500hrs by the Consultants will be dated for the next working day if it is a weekday and the following Monday (Tuesday if it is a Statutory Holiday) if it is received on a Friday.

1.36.8 It is the Mechanical Contractor's responsibility to ensure that RFI's are directed to the appropriate Consultant. For example, a slab core drilling request shall be directed to the Structural Engineer, the Mechanical and Prime Consultants shall be copied.

1.36.9 The Contractor shall submit Individual RFI's for items that are not related.

1.36.10 The Mechanical Consultant will respond to each RFI within five (5) working days. The Contractor shall factor this response time into the Schedule and shall submit the RFI's in a timely manner taking this into account.

1.36.11 The Contractor should submit RFI's as issues arise rather than accumulating multiple RFI and submitting them together. Where multiple RFI's are issued at the same time the Contractor shall identify the order of priority for each RFI. If an order of priority is not received they will be dated and processed in the order of receipt. If Multiple RFI's are received at the same time the five (5) working day response time may not be applicable.

PART 2 - EXECUTION

2.1 CLEANING

2.1.1 Clean interior and exterior of all systems including strainers.

2.1.2 Vacuum interior of ductwork and air handling units.

2.2 DEMONSTRATION

2.2.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

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

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

2.2.4 Instruction duration time requirements as specified in appropriate sections.

2.2.5 Consultant will record these demonstrations on video tape for future reference.

2.3 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

PART 2 - PRODUCTS

2.1 RESERVED

PART 3 - EXECUTION

3.1.1 Scheduling of Work:

.1 Notify and obtain agreement from Owner before connecting or making modification to existing electrical or mechanical services. Disruptions shall be kept to a minimum. Whenever the Contractor contemplates entering any occupied areas and any existing floors to carry out Work or to obstruct or take out of use any area, he shall make such request to the Owner in writing 72 hours before he intends to do the Work. Coordinate all work with the General Contractor.

3.1.2 Owner's Use of Existing Building:

.1 The existing buildings will remain in full use and occupancy throughout the majority of the construction of the Work. Refer to the Schedule provided by the General Contractor/Construction Manager.

3.1.3 Protection:

.1 Work shall include temporary, weathertight, dust tight partitions between areas, and enclosing areas within the building where Work is performed.

.2 Protection of existing building, including roofs, shall be substantial enough to prevent damage to them by falling objects, demolition, and mandatory construction traffic during new Work.

.3 Protection of property in, or on, existing building shall include equipment, furniture, and other similar furnishings, hardware, trim, and supplies, whether fixed to building or not.

.4 Take all precautions to ensure that no structural damage is caused to existing building by demolition and alternation Work.

.5 Ensure during demolition and construction Work that materials, components, and similar items to be reused are protected from damage, and that measures are taken to keep down dust and noise at all times.

.6 Take extraordinary means to protect relics, weathered surface, and materials and components which cannot be replaced.

.7 Provide all necessary coverings to protect existing surfaces from damage during course of renovation.

3.1.4 Removal of Existing Work:

.1 Remove building elements, components, materials, and equipment. Store and protect materials from damage for re-installation when Work above is complete.

.2 Store and protect relocated items until built into new locations.

.3 Limit removal of items to smallest areas possible, and make good disturbed existing Work.

.4 Remove debris and accumulated dirt from existing building immediately as it accumulates, on a daily basis. Ensure that during removal operations through the existing building that existing Work is not damaged and dirt, debris, and dust is not spread.

.5 Maintain Work areas in existing building constantly broom clean to avoid tracking of dirt into adjacent areas. Immediately clean up debris resulting from Work of Contract that is deposited in existing building outside of Work areas. Make a daily inspection to ensure that Work and construction access areas are maintained clean and undamaged as specified.

3.1.5 New and Replacement Work:

.1 Where existing work is altered, do all necessary cutting and fitting required to make satisfactory connections with existing work so as to leave entire work in a finished and acceptable condition.

.2 Execute work with least possible interference and disturbance to occupants, public and normal use of premises. Arrange with Consultant to facilitate execution of work.

.3 Make good all existing materials and finishes, which are not to be removed nor altered, but which are damaged or disturbed during the progress of work under this contract.

.4 Where existing work is to be made good, match the new work exactly to the old work in material, form, construction and finish, unless otherwise specified or approved.

3.1.6 Contractor's Use of Existing Building:

.1 Access of construction personnel to the buildings will be permitted only at locations approved by the Owner and General Contractor.

.2 Ensure that construction personnel perform Work in existing building only as required under the Contract, and that they do not use it as access to Work areas, except for Work in existing building, or for other approved purposes. Access for construction personnel to their Work areas shall be approved by the Owner before the Work commences.

.3 Use of washroom and other services in existing building by construction personnel is prohibited, unless agreed upon with the Owner. The Contractor shall clean all spaces needed at the completion of the job to the satisfaction of the Owner and General Contractor.

.4 Construction personnel shall use areas of the existing building for their purposes only as designated by the Owner and the General Contractor only while Work is in progress. Prohibit lounging and smoking in assigned areas. Keep assigned areas clean under Work of Contract, and return them to an "as was" condition at completion of construction. Make good damage to building, fixtures, and fittings caused during use by construction personnel by replacement with new Work. Include cost of installation and making good of other Work thereby affected in replacement.

.5 Construction personnel shall use areas of the existing buildings only in a manner as determined by the Work.

.6 All noisy and disrupted work shall be identified to the Owner and General Contractor with 48 hours minimum notice. Cooperate with the Owner in regards to any special arrangements which may have to be made as a result.

3.1.7 Existing Services:

.1 Shut down of existing services shall be identified in the required Construction Schedule identified in Section 22 05 06.

.2 Ensure that existing services are not damaged during demolition and construction. Immediately cut off and cap concealed services uncovered during Work by qualified mechanical and electrical workers.

.3 Relocate exposed existing mechanical and electrical services where alteration Work occurs.

.4 Do not interrupt mechanical or electrical services of the existing building except for temporary close-downs to make connections to new Work, and as approved by prior arrangements with Consultant and Owner. Give the General Contractor/Construction Manager, Consultant and Owner three working days written notice of intention to interrupt mechanical or electrical services in existing building in any area, and obtain written permission from Owner and General Contractor/Construction Manager.

.5 In no case shall services interruptions affect the total building.

.6 Should existing services be accidentally uncovered and disrupted, make complete restoration immediately, and provide adequate protection to avoid further disruption until alternative means of providing permanent continuation of the services are made.

.7 Payment for Work specified in the foregoing shall be made by the Contractor at no additional cost to the Owner, if, in the opinion of the Consultant, such Work could have been foreseen at time of tendering and which has been caused by lack of proper care and protection.

.8 Payment for Work specified in the foregoing shall be paid for by the Owner at standard rates established in the industry if, in the opinion of the Consultant, such Work could not have been foreseen at time of tendering.

.9 Advise the General Contractor/Construction Manager, Consultant and Owner of the commencement, duration and termination dates of this Work. Contractor shall keep a record of work hours, number of workers, tools, equipment rentals, quantities of material used, mileage, etc. to present with his claim if requested by Consultant or Owner.

.10 Unless otherwise specified, restore services on which Work is performed to original condition.

.11 Where services such as mechanical equipment, piping or ductwork are to be removed as part of the demolition work and/or services needs to be removed to facilitate installation of new services or equipment, the mechanical contractor shall review the site and ensure that these services are not " live" and that their removal/demolition will not cause any damage or any disturbance to the building or its occupant.

.12 If there are existing isolation valves in the piping, prior to cutting any of the piping, the contractor shall examine all of these isolating valves to ensure they are in good working

condition. If they are not in good condition and they can not be counted on to provide isolation of the system the Contractor shall either freeze the piping or drain it down prior to making the connection.

.13 If the Contractor discovers any issues or deficiencies with respect to the existing services during his/her site review the Contractor shall report these issues or deficiencies to the Consultant prior to any demolition work taking place. The Contractor shall be responsible for any damage caused by their failure to review the existing systems prior to proceeding with the work.

3.1.8 Return Air Ductwork

.1 Install temporary filters on all return air ducts within the construction zone prior to the start of construction.

.2 Install construction filters complete with Carbon Filtration for all Roof Top Units (RTU1 to RTU8). The Carbon Filter shall be installed either in the filter rack inside the RTU or secured to the exterior of the RTU on the face of the Intake Air Hood.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.2 WET INSULATION

1.2.1 Insulation that has become wet or contaminated shall not be installed.

1.2.2 Insulation that becomes wet on the job site shall be remediated in accordance with CCA 82 – 2004 “Mould Guidelines for the Canadian Construction Industry”.

1.3 REFERENCES

1.3.1 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as previously defined. This shall also include but not be limited to areas where the ceiling is not continuous from wall to wall.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

1.3.2 Reference Standards:

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

.1 ANSI/ASHRAE/IESNA 90.1-2015, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 NFPA

.1 NFPA 90A 2015 Installation of Air Conditioning and Ventilating Systems

.2 NFPA 90B 2015 Warm Air Heating and Air Conditioning Systems

.3 ASTM International Inc.

.1 ASTM A167 Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip

.2 ASTM E84

.3 ASTM B209M-2014, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.4 ASTM C335-2010, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.5 ASTM C411-2011, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.6 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.7 ASTM C547-2015, Standard Specification for Mineral Fiber Pipe Insulation.

.8 ASTM C553-2013, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.9 ASTM C612 2014, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.10 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.11 ASTM C921-2010, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.4 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB 51.2M Type 2, Thermal Insulation, Polystyrene, Boards and Pipe Coverings

.3 CAN/CGSB 51.12 Cement, Thermal Insulating and Finishing

.4 CAN/CGSB 51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering

.5 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.6 CGSB 51 GP 9M Thermal Insulation, Mineral Fibre, Sleeving for Piping and Round Ducting

.7 CGSB 51 11M Thermal insulation, Mineral Fibre, Blanket for Piping, Ducting, Machinery and Boilers

.8 CGSB 51 GP 53M Jacketing, Polyvinyl Chloride Sheet for Insulating Pipes, Vessels and Round Ducts

.5 Green Seal Environmental Standards (GSES)

.1 Standard GS-36-00, Commercial Adhesives.

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

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

1.4.1 Provide submittals in accordance with Front End Documents and Section 22 05 01.

1.4.2 Shop Drawings

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Description of equipment giving manufacturer's name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

1.4.3 Samples:

.1 Prior to ordering any insulation materials, prepare a sample board, with a cross section sample of all types of insulation, including exterior jacket and adhesive, properly identified for the various services and equipment on the project and state types of adhesives used. Submit the sample board to the Consultant for review. After review and acceptance, the sample board shall be kept on site for the duration of the project for reference. Deviation from the accepted samples will not be permitted.

.2 Affix typewritten label beneath sample indicating service.

1.4.4 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

1.5.1 Engage a licensed Insulation Application Contractor, specializing in, possessing an established reputation for this type of work.

1.6 DELIVERY, STORAGE AND HANDLING

1.6.1 Deliver, store and handle in accordance with Front End Documents.

1.6.2 Insulation, coverings, cements, adhesives, coatings etc., shall be shipped to the site in factory fabricated containers with manufacturer’s stamp or label affixed indicating the fire hazard ratings of the products, name of manufacturer and brand.

1.6.3 Retain insulation materials in their original containers, until immediately prior to application. Keep all materials dry during shipping and storage.

1.6.4 Retain adhesives in their original cartons or containers with the manufacturer’s name and catalogue number clearly identified on same.

1.6.5 Protect the insulation against dirt, water, chemical and mechanical damage before, during and after installation. Do not install damaged insulation. The Contractor shall remove all damaged insulation from the job site at no additional cost to the Owner/Architect.

1.6.6 Installed insulation, which has not been weatherproofed, shall be protected from inclement weather by an approved waterproof sheeting installed by the Contractor. The Contractor shall remove all wet or damaged insulation from the job site at no additional cost to the Owner/Architect.

1.6.7 Comply with all requirements of Local and Provincial Authorities having jurisdiction, the National Building Code and the Underwriters' Laboratory of Canada (ULC).

1.6.8 Fire retardant type insulation materials, coverings and adhesives with maximum 25 Flame Spread and maximum 50 Smoke Developed rating when tested shall be in accordance with CAN/ULC-S102 and NFPA 255 2006. Materials tested in accordance with ASTM C411 11 shall not flame, smoulder, glow or smoke at temperature(s) to which exposed in service.

1.6.9 Properly identify insulation materials, coverings and adhesives when required by Federal and/or Provincial Health and Safety WHMIS Legislation.

PART 2 - PRODUCTS

2.1 PERFORMANCE

2.1.1 Perform Thermal Insulation work in accordance with ASHRAE 90.1 - 2013 Standards and OBC Standard SB-10.

2.2 FIRE AND SMOKE RATING

2.2.1 Comply with NFPA 90A 2009 Standards. Maximum flame spread rating of 25 and maximum smoke developed rating of 50 shall be in accordance with NFPA255 2006 and CAN4-S102.

2.2.2 Material(s) tested in accordance with ASTM C411-05 shall not flame, smoulder, glow or smoke at temperature(s) to which exposed in service.

2.2.3 To CAN/ULC-S102, NFPA 90A 2009, NFPA 255 2006 and CAN4-S102..

.1 Maximum flame spread rating: 25

.2 Maximum smoke developed rating: 50.

2.3 INSULATION

2.3.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

2.3.2 Thermal conductivity ("k" factor) not to exceed specified values at 24C mean temperature when tested in accordance with ASTM C335.

2.4 C1 FIBROUS GLASS RIGID WITH VAPOUR BARRIER

2.4.1 Application:

.1 Insulation System D 4 for ducting temperature up to 450 F. (232 C.) on cold or dual temperature rectangular ducting as follows:

2.4.2 Material(s):

.1 rigid board insulation shall comply with ASTM C 612, Type 1;

.2 "k" @ 75 F. mean temperature 0.23 max. (0.033 @ 24 C.);

.3 maximum service temperature 450 F. (232 C.);

.4 rated at 25/50 per ASTM E84, UL 723 and NFPA 255;

.5 product must comply with the requirements of ASTM C 795 when being used over stainless steel,

2.4.3 Vapour Retardant Jacketing:

.1 Vapour retardant jacketing shall be bleached “KRAFT” paper reinforced with a glass fibre yarn and bonded to an aluminum foil or aluminum foil reinforced with a glass fibre yarn and laminated to fire resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapour barrier mastic as required;

.2 Fibreglass Reinforced Foil and Fire Retardant “KRAFT” Facing.

2.4.4 Standard of Acceptance: Knauf, Manson, Johns Manville.

2.5 C2 MINERAL FIBRE BLANKET WITH VAPOUR BARRIER

2.5.1 Application:

.1 Apply on round or oval ducting or concealed rectangular ductwork less than 32" (850 mm) wide, either cold or dual temperature, where such ducts would otherwise be insulated as described for D 4.

2.5.2 Material(s):

.1 duct wrap insulation shall comply with facing and shall meet ASTM C 533.

.2 “k” @ 75 F. mean temperature 0.27 max. (“k” @ 24□ C mean temperature 0.039.) when material compressed 25%; The density of the material shall be a minimum of 1.0 lb/ft3 (16 kg/m3).

.3 maximum service temperature 450 F.(232 C.);

.4 rated at 25/50 per ASTM E84, UL 723 and NFPA 255;

.5 product must comply with requirements of ASTM C 795 when used over stainless steel;

.6 material(s) faced with “FSK” shall have a permeance of 0.02 or less.

.7 material(s) must conform to ASHRAE 90.1 - 2013;

.8 Fiberglas Flexible Reinforced Foil and Flame Retardant “KRAFT”.

2.5.3 Standard of Acceptance: Knauf, Manson, Johns Manville.

2.6 JACKETS

2.6.1 PVC for Outdoor ductwork insulation

.1 Zero permeability, absolute vapor barrier for insulation cladding and jacketing applications.

.2 Jacketing shall be a 6.0 mil, 5-ply, self adhesive 15.6 N/25mm (55 oz/in) material that has high puncture 359.3 N (35.4 lb) and tear resistance 38.3 N (8.5 lb).

.3 Shall meet UL 723 10/20 Flame Spread / Smoke Rating.

.4 Temperature range 34 C to 149 C (-30 F to 300 F).

.5 Finish

.1 Exterior to be natural aluminum

.2 Interior to be white.

.6 Venture Clad PVC Jacketing 1577CW

2.6.2 Alternate Outdoors

.1 Outdoor vapour barrier mastic. Flintguard 110-26 complete with reinforcing glass fabric.

2.7 ACCESSORIES

2.7.1 Tape: Self adhesive, 100mm (4") wide under 25 Flame Spread and under 50 Smoke Developed rating.

2.7.2 Contact Adhesive: Quick-setting, non-flammable fire resistive adhesive to adhere fibrous glass to ducts. 15 Flame Spread and 0 Smoke Developed ratings.

.1 Acceptable Products: Foster: 85-20 Asbestos Free, Armstrong: 520.

2.7.3 Lap Seal Adhesive: Quick-setting adhesive for joints and lap sealing of vapour barriers. 10 Flame Spread and 0 Smoke Developed ratings.

.1 Acceptable Products: Foster: 85-75, Hardcast Foil-Grip 1402, Asbestos Free, Drion.

2.7.4 Canvas: Washable adhesive for cementing canvas lagging cloth to duct insulation.

.1 Acceptable Products: Foster: 30-36 Asbestos Free.

2.7.5 Pins:

.1 Weld pins 4mm (1/8") diameter with 35mm (1-1/2”) diameter head for installation through the insulation. Length to suit thickness of insulation.

.2 Weld Pins: If duct is over 600 mm (24") wide, use on bottom of duct.

.1 Acceptable Products: Duro Dyne: clip-pin.

.3 Weld pins 1/8” (2.0 mm) for installation prior to applying insulation. Length to suit thickness of insulation. Nylon retaining clips 1-1/4” (32 mm) square.

.1 Acceptable Products: Duro Dyne: spotter clips or stop clips as required.

.4 Pin Spacing

.1 For all systems pins shall be spaced at 18” (450mm) spacing.

2.7.6 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

2.8 DUCTWORK INSULATION SCHEDULE

APPLICATION	EXTENT	THICKNESS	AIR TEMPERATURE RANGE
Outside Air Intake	Outside air plenum and all ductwork up to mixing box. This includes all outside air ductwork from the point that it enters the building to the air handling units.	2" (50 mm)	-40 to 90°F (-40 to 32.2C)
Ductwork Exterior to the Building	All Ductwork installed exterior to the building.	3" (75 mm)	-40 to 90°F (-40 to 32.2C)
Silencers	Insulate all supply air silencers.	3" (75 mm)	-40 to 90°F (-40 to 32.2C)
Return Air	Required for ductwork exterior to the building and ductwork passing through unheated spaces where the temperature will be below 40°F (4.4 C). All other return air ductwork does not require insulation.	3" (75 mm)	-40 to 90°F (-40 to 32.2C)
Where insulation is installed on ductwork having flanged connections, increase duct insulation as required to provide a 1/2" (12 mm) cover on flanges and duct angles. For duct sizes 20" (500 mm) to 34" (850 mm) utilize either 1-1/2" (40 mm) flexible wrap or 1" (25 mm) rigid board insulation where 1" (25 mm) insulation is called for. For thicknesses greater than 1" utilize rigid board insulation. For ductwork exposed to the outdoors the top section of the insulation shall be sloped to ensure positive drainage from the top of the duct.			

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

3.2.1 Pressure test ductwork systems complete, witness and certify.

3.2.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

3.3.1 Apply insulation after required tests are completed and approved by the Engineer. Ensure surfaces are clean and dry when insulation is installed and during application of any finish.

3.3.2 Apply insulation as close as possible to equipment by grooving, scoring and bevelling insulation if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires or bands.

3.3.3 Fill joints, cracks, seams and depressions with bedding compound to form a smooth surface. Use a vapour retardant cement on cold equipment.

3.3.4 Provide vapour retardant jacket. Seal all vapour retardant jacket seams and penetrations with UL listed tapes or vapour retardant adhesive. Where service access is required bevel and seal ends of insulation.

3.3.5 Continue insulation through walls, sleeves, hangers and other duct penetrations except where prohibited by Code.

3.3.6 Work shall be performed by a qualified Insulation Journeymen.

3.3.7 Apply insulation and coverings at ambient conditions as required by manufacturers of insulations, adhesives and mastics.

3.3.8 Install insulation with smooth and even surfaces.

3.3.9 Replace removed insulation from existing ductwork to make tie in connections with new insulation. Cut back existing insulation a sufficient distance to make/form a neat and firm butt joint between the old and new insulation.

3.3.10 Secure insulation on exposed rectangular ductwork with welded impaling pins and speed washer type fasteners at 300mm (12") on centre. Provide a minimum of two (2) rows of fasteners on each side of the duct.

3.3.11 In addition to the mechanical fasteners, adhere insulation to the duct with fire resistive adhesive applied to the duct in 150mm (6") wide strips at 450mm (18") centres. Tightly butt all joints and breaks in the insulation and seal with fire resistive mastic and 75mm (3") wide scrim foil pressure sensitive tape. Cut off protruding ends of welded pins and cover speed washers with same tape to ensure a smooth application of exterior jacket.

3.3.12 Fasten insulation to rectangular ductwork less than 787mm (31") wide and round ductwork with adhesive applied in 150mm (6") wide strips at 450mm (18") centres. Tightly butt all joints and breaks in the insulation. Seal with fire resistive mastic and 75mm (3") wide scrim foil pressure sensitive tape. Use tying cord only to temporarily secure insulation until adhesive has set. Remove prior to application of exterior jacket.

3.3.13 Insulate access doors or removable panels in ductwork as separate units to permit opening or removal without damage to the adjoining insulation.

3.4 FINISHES

3.4.1 Finishes: conform to following table:

	Rectangular	**Round**
Outdoor, exposed to precipitation	Vapour Mastic or PVC	Vapour Mastic or PVC
Outdoor, elsewhere	Vapour Mastic or PVC	Vapour Mastic or PVC

3.5 CLEANING

3.5.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 EXTERIOR INSULATION INSTALLATION

3.6.1 All Applications

.1 Install on all insulation exposed to the outdoors.

.2 All penetrations of angle iron supports shall be completely sealed to weather.

.3 Built up centre to slope top surface of insulation to prevent ponding.

3.6.2 Vapour Mastic Insulation Application:

.1 All joints and penetrations shall be covered with two 3mm wet coats of vapour mastic reinforced with glass fabric.

.2 When dry, cover entire surface with 3mm coat of vapour mastic and while this coat is still wet, embed a layer of glass fabric, with all joints overlapped a minimum of 75mm and cover entire surface with another coat of mastic.

.3 Paint mastic assembly with white coloured weather resistant paint when it is dry.

3.6.3 PVC

.1 PVC jacketing must be installed in accordance with the Manufacturer's recommendations to provide a leak proof system.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This Section of the Specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01 - Mechanical General Provisions.

1.1.2 Ductwork and piping shall be installed in accordance with the proposed sections and layouts shown on the Mechanical Drawings. In accordance with Good Installation Practices all hydronic piping shall be installed below the ductwork. Where it is not possible for pipes running perpendicular to the ductwork to pass below the ducts it is acceptable for pipes to cross above the ducts. All pipes running parallel to ductwork shall not be run above the ductwork unless the proposed location is submitted on an interference drawing and the specific location where this is to occur is approved in writing by the Mechanical Department Representative.

1.2 SUMMARY

1.2.1 Section Includes:

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

1.3 REFERENCES

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

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

.1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A621 & A621M Specification for forming steel (FS), sheet and strip, carbon hot rolled.

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

.5 ASTM A924M General requirements for sheet steel, metallic coated by hot dip process.

1.3.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.3.4 National Fire Protection Association (NFPA).

.1 NFPA 90A-15, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-15, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

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

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible

.2 SMACNA HVAC Air Duct Leakage Test Manual,

1.3.6 IAQ Guideline for Occupied Buildings Under Construction

1.4 SUBMITTALS

1.4.1 Submit shop drawings and product data in accordance with Front End Documents and Section 22 05 01.

1.4.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Front End Documents prepared by the Construction Manager for the following:

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

.4 Ductwork Cleanser.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Protect on site stored or installed absorptive material from moisture damage.

1.5.2 Waste Management and Disposal:

.1 Provide in accordance with Front End Documents.

PART 2 - PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

2.1.1 All adhesives, sealants, paints and coatings used on or inside of building weatherproofing layer shall have a VOC content that is less than the content limits defined in Section 01 61 10 LEED Product Requirements.

2.2 SEAL CLASSIFICATION

2.2.1 Classification as follows:

2.2.2 Sealing classifications shall be in accordance with the Sealing Classifications Table as follows:

TABLE - SEALING CLASSIFICATION			
Seal Class	**Sealing Requirements**	**Applicable Static Pressure Construction Class**	**Allowable Leakage Rate**
A	All traverse joints, longitudinal seams and duct wall penetrations and connections made air tight with sealant and tape.	4" w.g. (1000 Pa) -4" w.g. (-1000 Pa)	1% of total system design at system operating pressure 4" (1000 Pa)
B	All transverse joints and longitudinal seams and connections made airtight with sealant, tape or a combination thereof	Up to 3" w.g. (750 Pa) -3" w.g. (-750 Pa) and less	1% of total system design at 3" w.g. (750 Pa)
C	All transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.	Up to 2" w.g. (500 Pa) -2" w.g. (500 Pa) and less	1.5% of total system design at 2" w.g. (500 Pa)
D	Unsealed seams and joints.	Up to 1" w.g. (250 Pa)-1" w.g. (-250 Pa) and less	5% of total system design at 1" w.g. (250 Pa)

2.3 PRESSURE CLASSIFICATIONS

2.3.1 Ductwork material shall be constructed in accordance with SMACNA ratings for the following pressure classifications. Pressure classifications shall be in accordance with the Pressure Classifications Table as follows:

TABLE - PRESSURE CLASSIFICATIONS			
Ductwork	**Operating Pressure**	**Seal Classification**	**Remarks**
Ductwork Exposed to the Outdoors	All	A	

2.4 TAPE

2.4.1 Refer to Section 23 33 00.

2.5 DUCT LEAKAGE TESTING

2.5.1 All ductwork that has a cross sectional area larger than 0.186 sq. m (2 square feet) shall be leak tested in accordance with the testing procedure identified in item 3.8 below and in accordance with SMACNA Air Duct Leakage Test Manual .

2.5.2 Leakage rates shall meet the % loss identified in item 2.2.2 above.

2.6 FITTINGS

2.6.1 Fabrication: to SMACNA.

2.6.2 Radiused elbows.

.1 Rectangular:

.1 Rectangular elbows shall be standard radius. Centreline radius: 1.5 times width of duct

.2 Short radius elbows with single thickness turning vanes shall only be utilized where shown on the drawings or agreed to by the Consultant.

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

2.6.3 Mitred elbows, rectangular:

.1 With double thickness turning vanes.

.2 Mitred elebows shall only be utilized where shown on the drawings or agreed to by the consultant.

2.6.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct. 45 degrees entry on branch and balancing damper.

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

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

.4 Main duct branches: with balancing damper.

2.6.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30degrees maximum included angle.

2.6.6 Offsets:

.1 Full, short radiused elbows as indicated.

2.6.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maintain full cross sectional area. Maximum included angles: as for transitions.

2.7 GALVANIZED STEEL

2.7.1 Lock forming quality: G60 zinc coating to ASTM A653/A653M and A924 standards.

2.7.2 Minimum yield strength for steel sheet and reinforcements shall be 30,000 psi (207 kPa).

2.7.3 The sheet metal gauge and requirement for reinforcement shall be in accordance with Tables 1 3 1/2" W.G. Static pressure to Table 1 7 4" W.G. Static pressure of SMACNA.

2.7.4 Fabrication shall be to SMACNA Standards.

2.7.5 Joints: To SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a Class C seal.

2.7.6 Standard of Acceptance: Namasco, Ductmate, Exanno, Nexus.

2.7.7 Joint reinforcement shall be in accordance with Tables 1 10 to 1 13 of the SMACNA Standard

2.8 ROUND DUCTWORK

2.8.1 All round ductwork up to 1500mm (60") in diameter shall be of Spiro lockseam construction with an intermediate standard rib to provide the rigidity equivalent to SMACNA Standard Gauge Spiral Duct.

2.8.2 G-60 coated galvanized of lockforming grade conforming to ASTM A635 and A924 standards. Minimum yield strength for steel and reinforcements shall be 30,000 psi. (207 Kpa.) with a thickness not less than for 24 gauge for duct diameters 250 mm to 425 mm (10" to 17"), 24 gauge for 450 mm. to 600 mm. (18" to 24"), 22 gauge for 650 mm. to 800 mm. (26" to 30") and 20 gauge for 850 mm. to 1500 mm. (32" to 60") diameters.

2.8.3 For duct diameters less than 225mm (9") use 26 gauge spiro duct without ribs.

2.8.4 Fittings:

.1 Elbows 100 mm to 200 mm (4" to 8"), shall be diestamped. Diestamped elbows shall be 2 piece construction with fully welded longitudinal seam.

.2 Elbows 225 mm to 900 mm (9" to 36") shall be standing seam construction.

.3 Elbows 950 mm to 1500 mm (38" to 60") shall be standard gore construction with joints riveted and bonded.

.4 Fittings shall be 1 gauge thicker than standard ductwork.

2.8.5 All couplings shall be slipped joint construction with minimum 50mm (2") insertion length. Duct sealer shall be applied on male end connectors before insertion and afterwards to cover the entire joint and sheet metal screws. Sheet metal screws shall be installed at a maximum 300mm (12") spacing, with a minimum of three (3) screws per joint. In large diameters, flanging gasketted joints are acceptable, in lieu of slip joints.

2.9 HANGERS AND SUPPORTS

2.9.1 Provide new roof mounted supports for the ductwork as indicated on the drawings.

2.9.2 Repair and refurbish existing duct supports as indicated on the drawings.

PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Do work in accordance with NFPA 90A, NFPA 90B, SMACNA and as indicated.

3.1.2 Do not break continuity of insulation vapour barrier with supports.

.1 Insulate support 100 mm (4”) beyond insulated duct

3.1.3 Support risers in accordance with SMACNA as indicated.

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

3.1.5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

3.2.1 Provide new roof mounted supports for the ductwork as indicated on the drawings.

3.2.2 Repair and refurbish existing duct supports as indicated on the drawings.

3.3 SEALING AND TAPING

3.3.1 Refer to section 23 33 00 “Air Duct Accessories”

3.4 LEAKAGE TESTS

3.4.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

3.4.2 Do leakage tests in sections.

3.4.3 Submit leakage test results for all sections.

3.4.4 Complete test before performance insulation or concealment Work.

3.5 DUCTWORK CLEANING

3.5.1 Clean the surface of the ductwork to be clear of insulation pins, adhesive, rust.

3.5.2 The cleaning shall be performed by using mechanical means such as scraping brushes. Use of chemicals to clean the ductwork shall be performed with caution to ensure that no damage is caused to the ductwork by chemical corrosion.

3.5.3 In the event chemicals are used the Contractor shall submit MSDS sheets for evaluation.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by Section 22 05 01.

1.2 SUMMARY

1.2.1 Section Includes:

.1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

.2 Sustainable requirements for construction and verification.

1.3 REFERENCES

1.3.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

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

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

1.4 SUBMITTALS

1.4.1 Submittals in accordance with Front End Documents and Section 22 05 01.

1.4.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Sealant and Tape

.2 Duct access doors.

.3 Instrument test ports.

1.4.3 Instructions: submit manufacturer's installation instructions.

1.4.4 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Front End Documents and Section 22 05 02.

PART 2 - PRODUCTS

2.1 GENERAL

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

2.2 FLEXIBLE CONNECTIONS

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

2.2.2 Material:

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

2.3 SEALANT AND TAPE

2.3.1 Water Based Sealant

.1 Sealant shall be a water based polymer emulsion.

.2 References

.1 UL 181B-M Listed

.2 UL 723 Classified

.3 ULS 102

.4 ASTM D522 (1/8" Mandrel Bend)

.5 ASTM D2202.

.3 Sealant shall conform to requirements of NFPA 90A & 90B

.4 VOC levels shall be equal to or less than 1.3 g/L and must qualify for LEED® Credit EQ 4.1

.5 Application temperature 1.7 C to 43.3 C (35 F to 110 F).

.6 Service temperature -17.8 C to 105.6 C (0 F to 222 F).

.7 Sealant to be non flammable and permanently flexible

.8 Product to have low shrinkage and shall not drip or sag

.9 Product to be rated for both indoor and outdoor use

.10 To be mildew resistant

.11 Rated for applications up to 15" w.g.

.12 Flame resistant (Flame spread 5, smoke developed 0)

.13 Standard of Acceptance: Ductmate

2.3.2 Where system pressures are in excess of 16" W.C. utilize a fibreglass mesh scrim to reinforce

the system. Where a gap exists which is larger than 1/4" provide fiberglass mesh scrim over the gap prior to applying the sealant.

2.4 ACCESS DOORS IN DUCTS

2.4.1 Ultra-low leakage, flat oval design, premium quality and performance access door.

2.4.2 Double flanged door with pre-punched holes on inner flange for surface mounting. (Type M1).

2.4.3 Camlock operation for positive seal and easy opening.

2.4.4 Standard Construction:

.1 Die-formed 22 ga. (.85) galv. flanged frame for extra strength.

.2 Die-formed 22 ga. (.85) galv. door panel for extra strength.

.3 25mm (1") insulation with 22 ga. (.85) galv. backing plate.

.4 5mm (3/16") dia. pre-punched attachment holes on inner flange for surface mounting (standard).

.5 Plated steel camlock fasteners.

.6 Positive bulb door seal.

.7 Layout template included on carton.

.8 Oval shaped opening adaptable to all ducts 127mm (5") or over.

2.4.5 Leakage Information:

.1 The maximum leakage at 8" w.g. (2 kPa):

.1 203mm x 127mm (8" x 5"): 1.02 l/min (0.036 cfm)

.2 305mm x 152mm (12" x 6"): 1.8 l/min (0.064 cfm)

.3 457mm x 254mm (18" x 10"): 3.78 l/min (0.133 cfm).

2.4.6 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

2.5 INSTRUMENT TEST

2.5.1 1.6 mm thick steel zinc plated after manufacture.

2.5.2 Cam lock handles with neoprene expansion plug and handle chain.

2.5.3 28 mm minimum inside diameter. Length to suit insulation thickness.

2.5.4 Neoprene mounting gasket.

2.5.5 Standard of Acceptance: Duro Dyne IP1 or IP2

2.6 SPIN-IN COLLARS

2.6.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

2.6.2 Sheet metal thickness to co-responding round duct standards.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

3.2.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm.

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

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

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

.2 Ensure slack material in flexible connection.

3.2.2 Access Doors and Viewing Panels:

.1 Size:

.1 600 x 600 mm for person size entry.

.2 450 x 450 mm for servicing entry.

.3 300 x 300 mm for viewing.

.4 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Upstream of Reheat coils.

.6 Elsewhere as indicated.

.3 All access doors that a man could fit through shall be provided with handles on both the interior and exterior of the ductwork.

3.2.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.
.2 Inlets and outlets of other fan systems.
.3 Main and sub-main ducts.
.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.
.2 In mixed air applications in locations as approved by Consultant.
.3 At inlet and outlet of coils.
.4 Downstream of junctions of two converging air streams of different temperatures.
.5 And as indicated.

.3 Controls

.1 Adjacent to all control sensors provided by the Controls Contractor to allow for verification of the readings provided by these sensors. This includes but is not limited to temperature, releative humidity, pressure sensors and flow stations.

3.3 CLEANING

3.3.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION