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SUBMITTAL PROCEDURES

1. GENERAL

1.1 Shop Drawings, Product Data and Other Submittals

.1 Arrange for the preparation of clearly identified Shop Drawings, Product data and other submittals as specified or as the Contract Administrator may reasonably request. Submittals are to clearly indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Submittals are to indicate their relationship to design drawings and specifications. Notify the Contract Administrator in writing of any deviations in submittals from the requirements of the Contract.

.2 Examine all submittals prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the Subcontractor for supplied items and of the Contractor for fabricated items. Submittals not stamped, signed and dated will be returned without being reviewed and stamped Re-submit".

.3 Submit submittals with reasonable promptness and in an orderly sequence so as to cause no delay in the Work. Failure to submit submittals in ample time is not to be considered sufficient reason for a change to the work schedule and no claim for extension of time by reason of such default will be allowed. Jointly prepare a schedule fixing the dates for submission and return of submittals.

.4 Submit three (3) copies of white prints and three (3) copies of all fixture cut sheets and brochures.

.5 The Contract Administrator will review and return submittals in accordance with the schedule agreed upon or otherwise with reasonable promptness so as to cause no delay in the Work.

.6 Review by the Contract Administrator is solely for general conformity with the Contract. The Contract Administrator does not warrant or represent that information is accurate or complete. Review by the Contract Administrator shall not relieve the Contractor of responsibility for errors or omissions in designs that are the Contractor's responsibility, and for conforming and correlating with all quantities and dimensions, performing the Work, selecting performance means and methods, coordinating with other parts of the Work and between trades, and performing the Work safely. Notwithstanding the review, the Contractor remains solely responsible for compliance with the Contract.

.7 Responsibility for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and coordination of all parts of the Work rests with the Contractor.

.8 Submittals will be returned to the Contractor with one of the following notations:

.1 When stamped "Reviewed – No Comment" or "Review by Consultant Not Required", distribute additional copies as required for execution of the Work.

.2 When stamped "Reviewed – As Noted", ensure that all copies for use are modified and distributed.

.3 When stamped "Reviewed – Revise and Resubmit", make the necessary revisions, as indicated, consistent with the Contract and submit again for review.

.9 Only submittals bearing "Reviewed – No Comment", "Review by Consultant Not Required", or "Reviewed – As Noted" shall be used on the Work unless otherwise authorized by the Contract Administrator.

.10 After submittals are stamped "Reviewed – No Comment" or "Reviewed – As Noted", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.

.11 Any adjustments made on submittals by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.

.12 Make changes in submittals which the Contract Administrator may require consistent with the Contract. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

.13 Submittals indicating design requirements not included in the Contract require the seal of a qualified Professional Engineer, registered in the province of the place of the Project. Engineering calculations shall be submitted for review, if requested, and sealed by a qualified Professional Engineer.

1.2 Samples

.1 Submit samples for the Contract Administrator’s review as specified or as the Contract Administrator may reasonably request. Clearly label samples as to origin and intended use in the Work. Reference samples to Drawings and Specifications.

.2 Submit samples with reasonable promptness and in orderly sequence so as to cause no delay in the Work. Failure to submit samples in ample time is not to be considered sufficient reason for a change to the work schedule and no claim for extension of time by reason of such default will be allowed. Jointly prepare a schedule fixing the dates for submission and return of samples.

.3 Notify the Contract Administrator in writing, at the time of submission, of any deviations in samples from requirements of the Contract.

.4 The Contract Administrator's review will be for conformity of design concept and general arrangement only. Such review is not to be considered relief of responsibility for errors or omissions in samples or of responsibility for meeting all requirements of the Contract.

.5 Any adjustments made on samples by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of the Work.

.6 Make changes in samples which the Contract Administrator may require consistent with the Contract.

1.3 Operating and Maintenance Manuals

.1 Not less than two (2) weeks prior to Substantial Performance, submit to the Contract Administrator five (5) copies of operating and maintenance manuals which shall contain information required by the Specifications as well as operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules. All instructions in these manuals shall be in simple language to guide the City in the proper operation and maintenance of his installation.

.2 Bind contents in a three-ring, hard covered, plastic jacketed binder.

.3 Index binder according to the following system:

Tab-1.0 Mechanical Systems:

Title page with clear plastic protection cover.

Tab-1.1 List of Mechanical Drawings:

Tab-1.2 System Descriptions:

Provide complete description of the operating sequence for all systems. Include detailed system description, with individual components described, explanation of how components interface with others and to the complete system, location of thermostats, controllers or operating variances, and controller operating setpoints.

Tab-1.3 Operating Division:

Provide complete and detailed operation of major components and systems. Provide information on location of components, how to energise switches and controls, how components interface with other components, operation of controls including operational sequence, operational changes for summer of winter operation, how to accomplish the changeover, complete trouble shooting sequence, emergency operating sequences in event of major component failure, and safeguards to indicate if equipment goes off-line.

Tab-1.4 Maintenance and Lubrication Division:

Provide general maintenance and lubrication schedule for major components to include daily, weekly, monthly, semi-annual and yearly checks and tasks. Explain how to execute maintenance tasks required for typical equipment such as bearings, drives, motors, and filters. Compile this information for equipment and separate from Shop Drawings.

Tab-1.5 List of Equipment Suppliers and Contractors:

Provide list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment.

Tab-Certification (2.0, 2.1, ...):

Include copy of test data on degreasing and flushing of heating system, analysis of system water taken at time system was put into operation, hydrostatic or air tests

performed on piping systems, equipment alignment certificates, copy of balancing data for air and water systems, copy of valve tag identification and pipe colour code, inspection approval certificates for plumbing system, heating and ventilation systems.

Tab-Shop Drawings and Maintenance Bulletins (3.0, 3.1, ...):

Provide materials received in compliance with clause 1.1

.4 The divider tabs shall be laminated Mylar plastic and coloured according to Section. The colouring is as follows: Mechanical Systems - 1.0 - 1.5 Orange; Certification - 2.0 - 2.4 Green; Shop Drawings & Maintenance - 3.0 - 3.17 Yellow. Plastic tabs with typewritten card insertions will not be accepted.

1.4 Record Drawings

.1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining Project Record Drawings.

.2 Accurately record significant deviations from the Contract caused by Site conditions and changes ordered by the Contract Administrator. Update daily.

.3 Record locations of concealed elements of mechanical and electrical services.

.4 Identify Drawings as "Project Record Copy". Maintain in good condition and make available for inspection on-site by the Contract Administrator at all times.

.5 On completion of the Work and prior to final inspection, submit Record Drawings to the Contract Administrator for review.

.6 Within one (1) month after return of Record Drawings by the Contract Administrator, obtain and pay for a complete set of original reproducible sepias. Transfer all changes from Record Drawings to the sepias and certify accuracy by signing each. Deliver sepias to the Contract Administrator.

1.5 Photographs and Publicity

.1 No photographs of the Site or of any portion of the Work will be permitted without prior approval of the Contract Administrator.

.2 No press or publicity releases will be permitted without prior approval of the Contract Administrator.

END OF SECTION

REFERENCES

1. GENERAL

1.1 Abbreviations and Acronyms

.1 Within the text of the Specifications, reference may be made to the following codes, standards and organizations:

AABC	Associated Air Balance Council
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHRI	Air-Conditioning, Heating and Refrigeration Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
APHA	American Public Health Association
API	American Petroleum Institute
ASA	Acoustical Society of America
ASCE	American Society of Civil Engineers
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	ASTM International (formerly American Society for Testing and Materials)
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWPA	American Wood Protection Association
AWS	American Welding Society
AWWA	American Water Works Association
BSI	British Standards Institution
CAN	National Standard of Canada
CBAC	Clay Brick Association of Canada

REFERENCES

CBM	Certified Ballast Manufacturers
CCA	Canadian Construction Association
CCMC	Canadian Construction Materials Centre
CEA	Canadian Electricity Association
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGA	Canadian Gas Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CISPI	Cast Iron Soil Pipe Institute
CITC	Canadian Institute of Timber Construction
CIU	Canadian Institute of Underwriters
CLA	Canadian Lumberman's Association
CLSAB	Canadian Lumber Standards Accreditation Board
CMAA	Crane Manufacturers Association of America
CMHC	Canada Mortgage and Housing Corporation
CPCA	Canadian Paint and Coatings Association
CPCI	Canadian Precast/Prestressed Concrete Institute
CRCA	Canadian Roofing Contractors' Association
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSDMA	Canadian Steel Door Manufacturers Association
CSPI	Corrugated Steel Pipe Institute
CSSBI	Canadian Sheet Steel Building Institute
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
CWDMA	Canadian Window & Door Manufacturers Association
DIN	Deutsche Industrie Norm
EEI	Edison Electric Institute
EEMAC	Electrical Equipment Manufacturers Association of Canada
EFC	Electro-Federation Canada
EIA	Electronic Industries Alliance
EJMA	Expansion Joint Manufacturers Association
ETL	Intertek Testing Services (formerly ETL Testing Laboratories)

REFERENCES

FCC	Federal Communications Commission (USA)
FM	Factory Mutual Engineering Corporation
FSA	Fluid Sealing Association
GANA	Glass Association of North America
IAO	Insurers' Advisory Organization
IAPMO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code (published by ICC)
IBRM	Institute of Boiler and Radiator Manufacturers
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IGMAC	Insulating Glass Manufacturers Association of Canada
ISA	Instrumentation, Systems, and Automation Society
ISO	International Organization for Standardization
LTIC	Laminated Timber Institute of Canada
MFMA	Metal Framing Manufacturers Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAMM	National Association of Architectural Metal Manufacturers (USA)
NABA	National Air Barrier Association
NACE	NACE International (formerly National Association of Corrosion Engineers)
NBC	National Building Code of Canada
NEBB	National Environmental Balancing Bureau (USA)
NEC	National Electrical Code (USA)
NECA	National Energy Conservation Association
NEMA	National Electrical Manufacturers Association (USA)
NESC	National Electric Safety Code (published by IEEE)
NFPA	National Fire Protection Association (USA)
NLGA	National Lumber Grades Authority
NRC	National Research Council Canada
OECI	Overhead Electrical Crane Institute
OSHA	Occupational Safety & Health Administration (USA)
PCA	Portland Cement Association

PCI	Precast Prestressed Concrete Institute
RSIC	Reinforcing Steel Institute of Canada
SAE	Society of Automotive Engineers
SBI	Steel Boilers Institute
SI	International System of Units
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association (USA)
SSPC	Steel Structures Painting Council
TAC	Transportation Association of Canada
TTMAC	Terrazzo Tile and Marble Association of Canada
UL	Underwriters Laboratories Inc.
ULC	Underwriters' Laboratories of Canada
WCB	Workers Compensation Board (Manitoba)

.2 Where specified standards are not dated, conform to latest issue of specified standards, including amendments and revisions, in effect three (3) Business Days before the Submission Deadline.

END OF SECTION

METAL FABRICATIONS

1. GENERAL

1.1 Work Included

.1 Support ‘W’ beams.

.2 Mechanical duct steel support frames.

.3 Additional welding to existing structural members as noted on drawings.

.4 Support channels, beams and angles attached to structural framing.

.5 Baseplates, bearing plates, anchor bolts, vertical and horizontal bracing.

.6 Miscellaneous steel items shown on Drawings.

.7 Welds, bolts, washers, nuts, and shims.

.8 Prime and galvanized structural and metal fabrication steel members and appurtenances.

.9 Field touch up of primed and galvanized surfaces including field welding.

1.2 Design Standards, Code Requirements

.1 Conform to requirements of CAN/CSA S16, CSA-S136, and the Canadian Institute of Steel Construction (CISC) "Code of Standard Practice for Buildings".

.2 Use loads, load combinations, and stress levels shown on Drawings and in accordance with the National Building Code of Canada 2005.

.3 Connections are to be designed by a Professional Engineer registered in the Province of Manitoba. Design connections for loads indicated on the Drawings as a minimum.

.4 Perform all welding in accordance with requirements of CSA W59.

1.3 Qualifications

.1 All Work is to be performed by a firm certified by the Canadian Welding Bureau to the requirements of CSA W47.1 in Division 2.

1.4 Inspection and Testing

.1 Shop and field inspection and testing will be performed by an inspection and testing firm appointed and paid by the City.

.2 Provide free access to all portions of Work in the shop and in the field and cooperate with appointed firm.

.3 Pay all additional costs for inspection and re-inspection due to defective workmanship or materials.

.4 If requested by the Contract Administrator, submit mill test reports, properly correlated to materials actually used.

.5 Radiographic and magnetic particle inspection of welds will be performed by the inspection and testing firm, in accordance with CSA W59 and ASTM E 709, when required by the Contract Administrator.

.6 Welds will be considered defective if they fail to meet quality requirements of CSA W59.

.7 Visually inspect all welds.

1.5 Shop Drawings, Submittals

.1 Provide a fabrication and erection schedule to the Contract Administrator prior to commencement of shop fabrication and field erection, in ample time to allow proper scheduling of inspection and testing.

.2 Submit details of typical connections and special connections for review prior to preparation of Shop Drawings.

.3 Shop Drawings and design briefs are to bear the seal of a Professional Engineer, registered in the Province of Manitoba.

.4 Submit Shop Drawings for review in accordance with Section 01 33 00 – Submittal Procedures.

.5 Clearly indicate profiles, sizes, spacing and locations of structural members, connections, attachments, reinforcing, anchorage, framed openings, size and type of fasteners, cambers and loads, accessories, column anchor bolt locations, setting details.

.6 Include erection Drawings, elevations, and details.

.7 Indicate welded connections using welding symbols in compliance with CISC Welding Standards. Clearly indicate net weld lengths.

.8 Shop Drawing review by the Contract Administrator is solely to ascertain conformance to the general design concept.

.9 Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.

.10 Review shall not relieve the Contractor of his responsibility for errors or omissions in Shop Drawings or for proper completion of the Work in accordance with the Contract Documents.

.11 Responsibility for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation, and coordination of all parts of the Work rests with the Contractor.

1.6 Coordination

.1 Coordinate all work with other subcontractor and City. As this building is occupied, Owner's must be advised in advance of any welding & flame cutting.

2. MATERIALS

.1 All materials shall be new.

.2 Structural steel wide flange sections (W shapes): conforming to CAN/CSA-G40.21, Grade 350W with minimum yield strength of 350 MPa, or conforming to ASTM A 992 or A 572, Grade 50 with minimum yield strength of 345 MPa.

.3 Structural Channels (C shapes): conforming to CAN/CSA-G40.21, Grade 300W with minimum yield strength of 300 MPa.

.4 Hollow Structural Sections: conforming to CAN/CSA-G40.21, Grade 350W Class 'C' with minimum yield strength of 350 MPa.

.5 Steel for beam end plates, ledger angles, and miscellaneous items: to CAN/CSA-G40.21, Grade 300W with minimum yield strength of 300 MPa.

.6 Base and cap plates: to CAN/CSA-G40.21, Type 300W with minimum yield strength of 300 MPa.

.7 Cold formed steel sections: conforming to CSA-S136, North American Specification for the Design of Cold-Formed Steel Structural Members.

.8 Bolts conforming to ASTM A 325 and ANSI ASME B18.2.6 heavy hex class 2A; nuts conforming to ASTM A 563; and washers conforming to ASTM F 436; painted to match fastened items.

.9 Welding Materials: conforming to CSA W59.

.10 Galvanizing for steel shapes: conforming to ASTM A 123/A 123M.

.11 Galvanizing for steel fasteners: conforming to ASTM A 153/A 153M.

.12 Touch-up galvanizing with minimum two (2) coats of zinc rich primer.

2.2 Fabrication

.1 Fabricate structural steel members in accordance with CAN/CSA-S16 and CSA-S136.

.2 Verify all Drawing dimensions prior to commencing fabrication.

.3 Provide connections for loads indicated on the Drawings as a minimum.

.4 Provide for field connections to be bolted except where field welded connections are shown on the Drawings or as required on the Shop Drawings. Bolted connections shall be bearing-type connections with the thread excluded from the planes of shear; connections with shear reversal shall be friction type connections.

.5 Accurately cut and mill column ends and bearing plates to assure full contact of bearing surfaces prior to welding.

.6 Close and weatherproof all gaps, butt joints, and connections exposed to exterior of building. All exposed welds shall be flush with surface of welded members, grind or file as required.

.7 Weld shear studs in place with stem perpendicular to member, in full fusion weld.

.8 Design and detail connections for structural steel so that corrosion potential is minimized. Cap and seal weld all exposed ends of HSS sections.

.9 Weld reinforcing bars to structural steel where acceptable to the Contract Administrator or as shown on Drawings in accordance with CSA W186.

2.3 Shop Primer & Galvanizing

.1 Clean all members, remove loose mill scale, rust, oil, dirt, and other foreign matter. As a minimum prepare surfaces according to SSPC-SP7/NACE No. 4 Brush-Off Blast Cleaning unless indicated otherwise. Blast profile shall not exceed 2 mil.

.2 Clean all members receiving galvanizing material to SSPC-SP10/NACE No. 2 Near-White Blast Cleaning.

.3 Apply two (2) coats of primer in the shop to all steel surfaces, except:

.1 Mechanical duct steel support frames which are galvanized.

.4 Apply paint under cover, on dry surfaces only, and when surface and air temperatures are above 5°C.

.5 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.

.6 Patch paint bolts, nuts, sharp edges and corners one coat before full prime coat is applied.

.7 Apply paint by brush or spray to dry film thickness recommended by Manufacturer, but not less than a dry film thickness of 0.05 mm.

3. EXECUTION

3.1 Examination

.1 Before starting erection, take field measurements and examine other Work that may affect this Work.

.2 Notify the Contract Administrator of any conditions that would prejudice proper installation of this Work.

.3 Commencement of this Work implies acceptance of existing conditions.

3.2 Damaged Members

.1 Repair or replace members damaged during transit or erection, before securing in position.

3.3 Erection

.1 Erect structural steel in accordance with CAN/CSA-S16 and Drawings.

.2 Field connections are to be bolted wherever possible.

.3 Do not field weld wet surfaces or during rain unless under cover.

.4 Do not weld at temperature below 5°C except with express permission of the Contract Administrator.

.5 Conform to requirements of CSA W59 for minimum preheat and interpass temperatures.

.6 Make adequate provision for all erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of necessary permanent bracing.

.7 Set column bases and other vertical members to design elevations on levelling nuts or steel wedges. Do not use wood wedges.

.8 Use only light drifting to draw parts together. Enlarge holes for bolted connections with reamers or twist drill only. Do not burn to form holes, enlarge holes, or match unfair holes.

.9 Erection error is not to exceed requirements of CAN/CSA-S16.

.10 Obtain Contract's written permission prior to field cutting or altering structural members.

.11 After erection field prime welds, nuts, bolts, and washers and touch up abrasions and damage to shop primed surfaces.

.12 Touch up all damaged shop finish paint, prime and finish paint all welds, nuts, bolts, and washers.

END OF SECTION

ROUGH CARPENTRY

1. GENERAL

1.1 Work Included

.1 Wood attached to sheet members.

.2 Wood treatment.

1.2 References

.1 CSA O80 - Wood Preservation.

.2 NLGA - Standard Grading Rules for Canadian Lumber.

.3 CSA O121 - Douglas Fir Plywood.

.4 CSA O141 - Softwood Lumber.

.5 CSA O151 - Canadian Softwood Plywood.

1.3 Quality Assurance

.1 Lumber grading agency: NLGA.

.2 Wood treatment: CSA O80.

1.4 Delivery, Storage, and Handling

.1 Protect Products of this Section under waterproof coverings.

2. PRODUCTS

2.1 Materials

.1 Softwood lumber: CSA O141, non-structural light grading 19% maximum moisture content.

.2 Plywood: CSA O121 - Douglas fir CSA O151 - softwood type, with waterproof glue.

.3 Fasteners: Hot dipped galvanized steel for exterior, high humidity, and treated wood locations; size and type to suit condition.

2.2 Wood Treatment

.1 Wood preservative pressure treatment: CSA O80 using waterborne preservative with 0.30% retainage, manufactured by Wolman.

3. EXECUTION

3.1 Site-Applied Wood Treatment

.1 Apply preservative treatment in accordance with CSA O80 Manufacturer's instructions.

.2 Treat Site-sawn ends.

.3 Allow preservative to cure prior to erecting members.

3.2 Installation

.1 Erect wood framing members level and plumb.

.2 Place miscellaneous blocking, nailing strips, framing and sheathing where indicated on the Drawings and as required for secure support of anchorage of other specified materials. Place members true to lines and levels. Secure rigidly in place.

END OF SECTION

JOINT SEALANTS

1. GENERAL

1.1 Work Included

.1 Supply and installation of all sealant and backing materials as required.

1.2 Environmental Conditions

.1 Sealant and substrate materials to be minimum 5°C.

.2 Should it become necessary to apply sealants below 5°C, consult sealant Manufacturer and follow their recommendations.

1.3 Reference Standards

.1 CAN/CGSB-19.13 - Sealing Compound, One Component, Elastomeric, Chemical Curing.

.2 CAN/CGSB-19.24 - Multicomponent, Chemical-Curing Sealing Compound.

.3 CAN/CGSB-19.17 - One Component Acrylic Emulsion Base Sealing Compound.

1.4 Warranty

.1 Warranty: include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

2. PRODUCTS

2.1 Materials

.1 Primers: type recommended by sealant manufacturer.

.2 Joint Fillers:

.1 General: compatible with primers and sealants, outsized 30 to 50%.

.2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.

.3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70.

.4 Polyvinyl Chloride or neoprene: extruded tubing with 6 mm minimum thick walls.

.5 Impregnated precompressed polyurethane foam sealant tape. Acceptable Product: Emseal “Grayflex”.

.3 Bond Beaker: pressure sensitive plastic tape, which will not bond to sealants.

.4 Sealants:

.1 Sealant shall be Ultraviolet resistant and ozone resistant, capable of supporting their own weight: conforming to CAN/CGSB-19.13.

.2 Sealants for vertical and horizontal non-traffic bearing joints, CAN/CGSB-19.24.

.3 Colour of sealants: to match adjacent surface. Colours to be selected by the Contract Administrator from standard colour range.

.4 Joint Cleaner: xylol, methylethyleketon or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

2.2 Acceptable Products

.1 For all non-traffic bearing joints unless indicated otherwise Dow Corning No. 790.

3. EXECUTION

3.1 Preparation

.1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.

.2 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease, and other coatings from nonferrous metals with joint cleaner.

.4 Prepare concrete, glazed, and vitreous surfaces to sealant Manufacturer's instructions.

.5 Examine joint sizes and correct to achieve depth ratio ½ of joint width with minimum width and depth of 6 mm, maximum width 25 mm.

.6 Install joint filler to achieve correct joint depth.

.7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.8 Apply bond breaker tape where required to Manufacturer's instructions.

.9 Prime sides of joints in accordance with sealant Manufacturer's instructions immediately prior to caulking.

3.2 Application

.1 Apply sealants, primers, joint fillers, bond breakers, to Manufacturer's instructions. Apply sealant using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.

.2 Apply sealant to joints between access frames to adjacent building components, around perimeter of every external opening, to control joints in concrete slabs and where indicated.

END OF SECTION

HVAC AIR DUCT CLEANING

1. GENERAL

1.1 Scope

.1 When the duct systems are completed and before any fan systems are operated, all new ductwork, plenums, silencers and air handling equipment shall be cleaned by compressed air and high power suction equipment.

2. PRODUCTS

2.1 Materials

.1 The sheet metal sub trade shall provide all necessary access doors to facilitate efficient ductwork cleaning as listed under installation.

3. EXECUTION

3.1 Installation

.1 Access doors shall be as specified in Section 23 33 01, "Air Ducts Accessories". Access panels with screws are not acceptable.

.2 For duct cleaning system utilizing compressed air and mechanical brush, suitably sized access points with positive locking cover shall be installed at 3 m interval in the duct work and on both sides of dampers and turning vanes, etc.

.3 Access system shall be reusable to allow for future inspection or cleaning.

.4 After running the existing AHU-1 with the new ductwork for a period of 2 to 5 days, the filter media in AHU-1 shall be replaced with new filter media provided by the Contractor.

.5 Each aspect of the system shall be cleaned regardless of the size, type or configuration. Dirt clinging to the sides or top of ducting must be removed and left as clean as the bottom.

3.2 Inspection

.1 The cleanliness of ductwork shall be inspected by the Contract Administrator.

.2 Any ductwork found to be dirty shall be redone through its entire length at no extra cost to the City.

END OF SECTION

COMMON WORK RESULTS FOR HVAC

1. GENERAL

1.1 Intent

.1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.

.2 Drawings of this Division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Follow Manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of the Contract.

.4 Install equipment generally in locations and routes shown. Run ductwork close to building structure, parallel to building lines to maximize headroom and with minimum interference with other services and free space. Remove and replace improperly installed equipment to satisfaction of the Contract Administrator at no extra cost.

.5 Install equipment to provide access and ease of maintenance.

.6 Connect to equipment specified in other Sections.

.7 Install control dampers and other devices on ducts.

1.2 Coordination of Work

.1 Make reference to electrical and structural Drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork and equipment, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on-site before fabricating or installing any materials or equipment.

.2 Where dimensional details are required, work with the applicable architectural and structural Drawings.

1.3 Quality of Work

.1 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Contract Administrator.

1.4 Shop Drawings

.1 Provide Shop Drawings for all scheduled equipment and as specified in sections of this Specification.

.2 Identify materials and equipment by Manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Contract Administrator's office or on the Internet.

.3 Clearly mark submittals using arrows, underlining or circling to show differences from specified, e.g. ratings, capacities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as fan and motor vibration isolators and springs.

.4 Include weights, dimensional, and technical data sufficient to check if equipment meets requirements. Include wiring and service connection data and motor sizes.

.5 Installed materials and equipment shall meet specified requirements regardless of whether or not Shop Drawings are reviewed by the Contract Administrator.

.6 Do not order equipment or material until the Contract Administrator has reviewed and returned Shop Drawings.

.7 Retain one (1) copy of Shop Drawings on Site for review.

1.5 Salvage

.1 Remove from Site all equipment and ducting which is no longer required because of Work under this Contract.

.2 Turn over and deliver decommissioned return fan, F-1 and associated controls back to the City at site grade level. Exact delivery location at site grade level shall be coordinated with the City.

1.6 Cutting, Patching and Coring

.1 Provide holes and sleeves, cutting and fitting required for mechanical Work.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Obtain written approval from the Contract Administrator before cutting or burning structural members.

.4 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

.5 Provide a minimum of 48 hours notice to the Contract Administrator for all smoke or heat generating activities performed indoors.

1.7 Installation of Equipment

.1 Unions and flanges shall be provided on ductwork to permit easy removal of equipment.

.2 Maintain permanent access to equipment for maintenance.

1.8 Fire-Stopping

.1 Fire-stop all ducts, conduit and wire penetrations through floors and walls, designated as fire and/or smoke separations. The Contractor is required to coordinate with the architectural drawings to contractual rated wall types and installation details.

.2 Fire-stopping materials to meet CAN/ULC S115. Acceptable Materials: "Tremco" or "National Firestopping",

.3 Preparation of surfaces and installation of fire-stopping materials shall be carried out as per manufacturer's instructions.

1.9 Connections to Existing Services

.1 Maintain liaison with the City and provide a schedule to interrupt, re-route or connect to heating systems with minimum interruption of services.

.2 Major services shall not be interrupted before all preparatory work is completed and all required materials are on-site. Provide a minimum of 48 hours notice for all service shutdown.

.3 The following shall be performed before removing existing return fan F-1 and ductwork out of service to minimize HVAC shutdown time:

.1 All new roof top equipment shall be installed as complete as possible without interfering with existing HVAC system.

.2 Perform start-up test on new AHU-2 to ensure proper operation.

.3 Remove existing exhaust and outside air hoods.

.4 Prepare existing exhaust duct penthouse to allow removal of return fan and ductwork from 4th floor.

.4 Upon completion of the above points, coordinate shutdown of existing HVAC system, decommission and remove require equipment, and tie new equipment with existing system.

.5 New equipment and ductwork shall be clean and free of debris before turning back on newly modified HVAC system.

.6 Interruptions and shutdowns of existing services shall be by the building/plant maintenance staff.

1.10 Equipment and Materials

.1 Materials and equipment installed shall be new, full weight and of quality specified.

.2 Each major component of equipment shall bear manufacturer’s name, address, catalogue and serial number in a conspicuous place.

.3 Where two or more products of the same type are required, products shall be of the same manufacturer.

1.11 Equipment Protection and Clean-Up

.1 Protect equipment and materials in storage on-site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out unsealed bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

1.12 Electrical Motors

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI. All motors to be CSA labelled. All motors to be approved for use in the designated area classification by the Provincial Electrical Protection Branch.

.3 All motors intended for use with a variable speed drive (variance frequency drive) shall be inverter duty rated. Variable speed drive shall be matched to motor.

.4 Unless specified otherwise, provide motors designed for full voltage starting, EEMAC Design B. Motors driving high torque or high inertia loads may be EEMAC Design C or D.

.5 Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection.

.6 All motors shall be 1800 rpm except where indicated.

.7 Provide motors with grease or oil lubricated anti-friction type ball or roller bearings.

.8 Provide motors designed with Class B insulation; Class F insulation for totally enclosed motors.

.9 Where motor power is stated in watts or kilowatts, nominal motor horsepower multiplied by 746 or 0.746 respectively, has been used as the conversion factor.

.10 All motors shall be premium efficiency rated according to NEMA standards unless specified otherwise.

1.13 Access Doors

.1 Provide access doors for maintenance or adjustment purposes for all mechanical system components

.2 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be ULC-listed.

.3 Sizes to be 200 mm x 200 mm for cleanout, 300 mm x 300 mm for hand 600 mm x 600 mm for body access minimum.

.4 Provide ULC-listed fire rated access doors installed in rated wall and ceilings.

1.14 Miscellaneous Metals

.1 Provide all necessary miscellaneous metals to hang or support materials, equipment and provide access for work under this Contract.

.2 All miscellaneous metals shall be prime and painted to match existing.

.3 Miscellaneous metals shall include but are not limited to:

.1 Support for equipment and ductwork.

1.15 Identification

.1 Tag automatic controls, instruments and relays and match/key to control shop drawing identification numbers. Tag all equipment and control panels.

.2 Identify electric starting switches and controls equipment supplied under this Division with lamacoid plates having 6 mm (1/4 inch) minimum letter size. Identification to state equipment controlled.

1.16 Temporary Heat

.1 Do not use the permanent system for temporary heating purposes without written permission from the Contract Administrator.

1.17 Temporary or Trial Usage

.1 Temporary or trial usage by the City or Contract Administrator of mechanical equipment supplied under Contract shall not represent acceptance.

.2 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

.3 Avoid thermal shock to heating system by coordination with the City during planning, construction and operation of temporary heating system.

2. PRODUCTS

2.1 Acceptable Manufacturers/Suppliers and Agencies

.1 The following listed manufacturers are acceptable for their ability to meet the general design intent, quality and performance characteristics of the specified product. The list does not endorse the acceptability of all products available from the listed manufacturers/suppliers.

.2 It remains the responsibility of the Contractor to ensure the products supplied are equal to the specified products in every respect, operate as intended, and meet the performance specifications and physical dimensions of the specified product.

.3 The Contractor shall be fully responsible for any additional Work or materials, to accommodate the use of equipment from the acceptable manufacturers and suppliers list.

.4 Submit within fourteen (14) days of Contract award a copy of the list underlining the name of the Manufacturer whose price was carried in the Bid Opportunity. If no manufacturers names are submitted, it will be assumed that the price carried in the Bid Opportunity was that of the specified manufacturer or where the specified product is generic, the first acceptable manufacturer listed for each item and equipment.

.5 List of Acceptable Manufacturers/Suppliers and Agencies:

.1	Air Handling Unit	McQuay, York
.2	Electric Unit Heater	CCI Thermal, Chromalox
.3	Access Doors	Maxam, Acudor, Milcor, Can.Aqua, Mifab, The Williams Brothers Corporation
.4	Air Terminals - Grilles Registers, Diffusers	E.H. Price, Titus, Anemostat, Nailor
.5	Controls Contractors and/or Suppliers	Johnson Controls
.6	Dampers	Tamco, Controlled Air, Ruskin, Canadian Advanced Air, Maxam, Nailor
.7	Silencers	Vibro-Acoustics, JP Environmental, IAC, EH Price
.8	Isolation Rail	Vibro-Acoustics, Kinetics, Mason

2.2 Counter Flashing Materials

.1 Counterflashings: galvanized sheet steel of 0.85 mm (22 ga) minimum thickness.

.2 Counterflashings are attached to mechanical equipment and lap the base flashings on the roof curbs.

.3 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.

.4 Vertical flange section of roof jacks shall be screwed to face of curb.

3. EXECUTION

.1 Not Applicable.

END OF SECTION

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1. GENERAL

1.1 Scope

.1 Duct hangers and supports

.2 Flashing for mechanical equipment

.3 Sleeving for mechanical equipment

1.2 Reference Standards

.1 Duct hangers shall follow the recommendations of the current edition of the SMACNA Duct Manuals.

1.3 General Requirements

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in equipment.

.3 Select hangers and supports for the service and in accordance with the Manufacturer's recommended maximum loading. Hangers shall have a 5.0 safety factor.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment. Provide sleeves for duct penetrations through walls, ceilings, floors and footings.

.6 Dielectrically isolate dissimilar metals.

.7 Obtain approval from the Contract Administrator prior to using percussion type fastenings.

.8 Use of equipment for hanger supports is not permitted.

.9 Use of perforated band iron, wire or chain as hangers is not permitted.

.10 Do not weld ductwork or equipment supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the Contract Administrator.

.11 Where deemed necessary by the Contract Administrator the Contractor shall, at his own cost, employ a structural engineer to design equipment supports.

2. PRODUCTS

2.1 Duct Hangers and Supports

.1 Conform to current edition of SMACNA handbooks.

2.2 Flashing

.1 Steel Flashing: 0.55 mm (26 ga) galvanised steel.

2.3 Sleeves

.1 Ducts: Form sleeves with galvanised steel.

.2 Size large enough to allow for expansion with continuous insulation.

2.4 Finishes on Hangers and Supports

.1 All steel hangers and supports shall be galvanised or factory primed with alkyd red oxide primer to CAN/CGSB-1.40.

3. EXECUTION

3.1 Low Velocity Duct Hangers and Supports

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 mm x 1.6 mm (16 ga) at 3000 mm spacing.

.2 790 to 1200 mm wide: 40 mm x 1.6 mm (16 ga) at 3000 mm spacing.

.3 Over 1200 mm wide: 40 mm x 1.6 mm (16 ga) at 2400 mm spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 mm x 1.6 mm (16 ga) or 25 x 25 x 3 mm (11 ga) at 2400 mm spacing.

.2 475 mm to 1000 mm wide: 40 mm x 40 mm x 3 mm (11 ga) at 1200 mm spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3600 mm spacing:

.1 Up to 600 mm wide: 40 mm x 1.6 mm (16 ga).

.2 625 mm to 900 mm wide: 25 mm x 25 mm x 3 mm (11 ga).

.3 925 mm to 1200 mm wide: 30 mm x 30 mm x 3 mm (11 ga).

.4 Over 1200 mm wide: 50 mm x 50 mm x 3 mm (11 ga).

.4 Vertical Duct Floor Supports Minimum Sizes, Riveted or Screwed to Ducts:

.1 Up to 1500 mm wide: 40 mm x 40 mm x 3 mm (11 ga).

.2 Over 1500 mm wide: 50 mm x 50 mm x 3 mm (11 ga).

3.2 Equipment Bases and Supports

.1 Construct supports of structural steel members to brace and fasten with flanges bolted to structure.

.2 Rigidly anchor ducts immediately after vibration connections to equipment.

3.3 Flashing

.1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

.2 Provide curbs for mechanical roof installations minimum 200 mm high. Flash and counterflash with steel; solder and make waterproof.

3.4 Sleeves

.1 Ductwork passing through floor, ceiling or wall, close off space between duct and sleeve and non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

END OF SECTION

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

1. GENERAL

1.1 Scope

.1 Curb mounted rooftop isolation rail for AHU-2 fan and exhaust sections.

1.2 Submittals

.1 Submit shop drawings of factory fabricated assemblies.

.2 Submittals shall include dimensions, materials, attachment and anchorage requirements. Indicate compliance with each specification item herein.

2. PRODUCTS

2.1 Isolation Rails

.1 Isolation springs shall have a minimum static spring deflection of 25 mm (1 inch).

.2 Springs: All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have kx/ky ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity – color striping is not considered adequate.

.3 Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be galvanized, powder-coated enamel, or painted with rust-resistant paint. Hot-dipped galvanized housings shall be provided as indicated on the Schedule.

.4 Isolators:

.1 Curb-mounted Spring Rail: Type RTR - Rail type, with integral spring isolators designed to fit over the roof curb and under the isolated equipment (AHU-2 fan and exhaust section). Wind resistance shall be provided by means of resilient snubbers with a minimum clearance of 6 mm (0.25 inch) so as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof, flexible neoprene connection joining the outside perimeter of the upper and lower members. The rail shall be manufactured as a single piece wherever possible. An optional acoustic barrier package shall be provided as required and scheduled.

.5 Standard of acceptance: Vibro-Acoustics model RTR

3. EXECUTION

3.1 General

.1 Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint devices to ensure adequate space and prevent edge breakout failures.

.2 Coordinate locations and sizes of structural supports with locations of vibration isolators and seismic restraints (e.g., roof curbs etc.).

3.2 Vibration Isolation

.1 Block and shim all bases level so that all ductwork and piping connections can be made to a rigid system at the proper operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and the building structure.

.2 Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

.3 Provide spring-loaded thrust restraints for fans and air handling units where movement under any operating condition will exceed 10 mm (0.375 inch).

3.3 Inspection and Certification

.1 After installation, arrange and pay for the vibration isolation product manufacturer to visit the site to verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that isolators are adjusted, with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.

END OF SECTION

TESTING, ADJUSTING AND BALANCING FOR HVAC

1. GENERAL

1.1 Scope

.1 Balance, adjust, and test air systems and equipment and submit reports in identical units to those shown on Contract Documents.

.2 Contractor shall prepare the facility for balancing.

1.2 Quality Assurance

.1 Work specified in this Section shall be performed by an Independent Agency specialising in this type of Work, and paid by the Contractor.

.2 Test equipment and material where required by Specification or authority having jurisdiction to demonstrate its proper and safe operation.

.3 Test procedures in accordance with the current applicable portions of ASME, ASHRAE, and other recognised test codes as far as field conditions permit.

.4 Perform tests on-site to the satisfaction of the Contract Administrator.

.5 Equipment shall not be concealed or covered until inspected and approved by the Contract Administrator. Provide ample written notice (2 working days) to the Contract Administrator before tests.

.6 Use factory trained representatives and submit Manufacturer's check sheets for starting the following specialty equipment.

.1 Air handling units

.2 Control components

.7 Prior to starting, testing, balancing, adjusting and cleaning processes, verify with Contract Administrator any tests required to be witnessed. Provide sufficient notice to Contract Administrator prior to commencement of procedures.

.8 Contract Administrator shall be allowed to witness any testing, adjusting, starting, balancing and cleaning procedures.

.9 Assume all costs associated with starting and testing, including the supply of testing or cleaning materials.

.10 Prior to starting equipment or systems, secure and review Manufacturer's installation, operation and starting instructions. Read in conjunction with procedures defined herein.

.11 Use Manufacturer's or Supplier's starting personnel where required to ensure integrity of Manufacturer's warranty.

.12 Compare installations to published Manufacturer's data and record discrepancies. Items proving detrimental to equipment performance shall be corrected prior to equipment starting.

.13 Some processes involved in starting procedures defined in this Section may be duplications of authorities' verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.14 All starting, testing procedures shall be in accordance with applicable portions of the latest, current ASME, ASHRAE, AABC, CSA, NFPA, SMACNA and ASTM codes and standards.

.15 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the reading and tests.

.16 Assume all liabilities associated with starting, testing and balancing procedures.

.17 The City shall be notified of all shutdown of major services including but not limited to turning on or off fans and air handling equipment.

1.3 Submittals

.1 Obtain certificates of approval, acceptance, and comply with current rules and regulations from authorities having jurisdiction and include in Operating and Maintenance Manuals.

.2 Perform tests as specified and upon completion of mechanical installation. Provide certification of tests with detailed data as required. Itemise each test as to time performed and personnel responsible. Include in Operating and Maintenance Manuals.

1.4 Liability

.1 Take charge of work area during tests, assume responsibility for damages in event of injury to personnel, building or equipment and bear costs for liability, repairs, and restoration in this connection.

1.5 Balancing Agenda

.1 General: Submit balancing agenda to the Contract Administrator for review at least 30 days prior to the start of balancing Work. Start balancing Work after agenda has been approved. Include descriptive data, procedure data, and sample forms in agenda.

.2 Descriptive Data: General description of each system including associated equipment and different operation cycles, listing of flow and terminal measurements to be performed.

.3 Procedure Data: Procedures for converting test measurements to establish compliance with requirements, specify type of instrument to be used, method of instrument application (by sketch) and correction factors.

.4 Sample Forms: Form showing application of procedures to typical systems.

1.6 Balance Report

.1 Submit two (2) copies of draft balancing reports to Contract Administrator for review.

.2 Provide copies of final reports in Operating and Maintenance Manuals.

.3 Include types, serial number and dates of calibration of instruments in the reports.

1.7 System Data

.1 The system shall be tested and balanced for each of the following system configurations:

.1 100% exhaust system configuration:

.1 AHU-1 running 100% speed

.2 AHU-2 running 100% speed

.3 AHU-2 exhaust air damper (MD-1) fully open

.4 AHU-2 mixed air damper (MD-2) fully closed

.5 AHU-2 outside air damper (MD-3) fully open

.2 100% recirculation system configuration:

.1 AHU-1 running 100% speed

.2 AHU-2 running 100% speed

.3 AHU-2 exhaust air damper (MD-1) fully closed

.4 AHU-2 mixed air damper (MD-2) fully open

.5 AHU-2 outside air damper (MD-3) fully closed

.2 The following general design information shall be provided for the report:

.1 **AHU-1** (Existing)
Design Data:
Total air flow rate;
Fan total static pressure;
System static pressure;
Motor kW (hp), r/min, amps, volts, phase;
Outside air flow rate L/s (cfm);
Fan r/min;
Fan kW (hp);
Manufacturer and model;
Size;
Arrangement discharge and class.

.2 **F-1** (Existing, to be removed)
Design Data:
Total air flow rate;
Fan total static pressure;
System static pressure;
Motor kW (hp), r/min, amps, volts, phase;
Outside air flow rate L/s (cfm);

Fan r/min;
Fan kW (hp);
Manufacturer and model;
Size;
Arrangement discharge and class.

.3 **AHU-2** (New)
Design Data:
Total air flow rate;
Fan total static pressure;
System static pressure;
Motor kW (hp), r/min, amps, volts, phase;
Outside air flow rate L/s (cfm);
Fan r/min;
Fan kW (hp);
Manufacturer and model;
Size;
Arrangement discharge and class.

.3 The following test information shall be provided each system configuration as mentioned above:

.1 **AHU-1** (Existing)
Tested air flow rate and VFD speed setting;
Fan total static pressure;
System static pressure;
Fan r/min;
Motor operating amperage;
Inlet and outlet, dry and wet bulb temperatures.

.2 **AHU-2** (New)
Tested air flow rate and VFD speed setting;
Fan total static pressure;
System static pressure;
Fan r/min;
Motor operating amperage;
Inlet and outlet, dry and wet bulb temperatures.

.4 The locations of all test points shall also be indicated on a sketch.

2. PRODUCTS

2.1 Instruments

.1 Provide calibration histories for each instrument. Recalibration or use of other instruments may be requested when accuracy of readings is questionable.

3. EXECUTION

3.1 General Procedure

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of Work are properly coordinated prior to the commencement of each particular testing procedure. Establish all necessary manpower requirements.

.3 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.

.4 Confirm voltages and operating amperages at full load.

.5 Failure to follow instruction pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by the City at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from Site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.

.6 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.7 Balancing shall be performed to the following accuracies:

.1 Air central equipment $\pm$5%

3.2 Air System Procedure

.1 Perform balancing, adjusting and testing with building doors and windows in their normal operation position.

.2 Replace filter media in AHU-1 with new filters.

.3 The following procedure shall be adopted for central systems:

.1 Balance central apparatus to ±10% air flow.

.2 Balance branches, mains to ±10% air flow.

.3 Recheck central apparatus.

.4 Rebalance central apparatus to ±5%.

.4 Take static pressure readings and air supply temperature readings at ten (10) points on each air system.

.5 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross sectional area. If readings are inconsistent across duct, relocate to two duct diameters or widths and re-do traverse.

.6 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control only by duct internal devices such as dampers and splitters.

.7 Vary total system air quantities by adjustment of fan speeds.

.8 The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurisation levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Full multi-storey building test pressure conditions at ground, intermediate and upper levels. Front doors, exits, elevator shafts, should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

3.3 Balancing Report

.1 Submit draft copies of reports prior to final acceptance of project.

.2 Include types, serial number and dates of calibration of instruments.

.3 Record test data on CAD Drawings made from the latest available revised set of mechanical Drawings and submit copies upon completion of the balancing contract for inclusion in equipment and maintenance manuals. CAD drawings available from the Contract Administrator upon request.

.4 Submit with report, fan curves with operating conditions plotted.

.5 Report shall include all system data outlined in clauses 1.7 of this Section.

3.4 Bring the work to an operating state and ready for balancing, including:

.1 Clean equipment.

.2 Replace filters with specified filters prior to balancing.

.3 Verify lubrication of equipment.

.4 Complete the "start-up" of equipment.

.5 Check rotation and alignment of rotating equipment and tension of belted drives.

.6 Set control points of automatic apparatus, check-out sequence of operation.

.7 Make available control diagrams and sequence of operation.

.8 Clean Work, remove temporary tags, stickers, and coverings.

.9 Make available one (1) copy of Maintenance Manuals especially for use in balancing.

3.5 Pulleys and Sheaves

.1 Provide and install pulleys and sheaves for rotating equipment, as required to properly balance the systems to design flows, without additional cost to the City.

END OF SECTION

SILENCER SCHEDULE

1.1 Silencer Schedule

Tag	Qty	Fan System	Face Dimension W (in)	Face Dimension H (in)	Length (in)	Flow cfm	Velocity ft/min	Silencer P.D.* in wg	P.D. incl. System Effects in wg	Dynamic Insertion Loss Generated Noise 63	125	250	500	1000	2000	4000	8000	Vibro-Acoustics Model
SA1	1	AHU2	54	54	72	18,000	-889	0.05	0.11	7	10	14	26	28	29	22	18	RED-UHV-F2
										60	44	42	32	39	31	<10	17	
SA2	1	AHU2	60	60	72	18,000	+720	0.03	0.04	8	9	10	23	24	25	18	17	RED-UHV-F1
										62	34	25	23	25	21	<10	14	

END OF SECTION

DECENTRALIZED UNITARY HVAC EQUIPMENT SCHEDULE

1.1 Unit Heater Schedule

Tag	UH-1
Location	AHU-2 Outside Air Section
Type	Electrical
Element kW	3
Element Power Supply, V/Ph/Hz	208/3/60
Fan Motor Power, kW (hp)	0.373 (0.5)
Fan Motor rpm	1725
Fan Motor Power Supply, V/Ph/Hz	208/3/60
Discharge Air Temp. Rise °C	7.5
Air Volume L/s	330
Output Air Velocity m/s	4.0
Manufacturer	Ruffneck
Model No.	CR1-208-3-60-030
Accessories & Remarks	c/w built –in Thermostat XTB and Mounting Bracket for mounting from steelwork

Notes: Thermostat temperature range -15 to 40°C

END OF SECTION

DUCT INSULATION

1. GENERAL

1.1 Scope

.1 Duct thermal insulation.

.2 Duct acoustic insulation.

.3 Outdoor mounted ductwork.

1.2 Quality Assurance

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet fire and smoke hazard ratings as stated in this Section and defined in applicable current building codes.

1.3 Submittals

.1 Submit Shop Drawings which indicate complete material data, "K" value temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

1.4 Job Conditions

.1 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement, poor workmanship or material defects.

2. PRODUCTS

2.1 General

.1 Insulation Material, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives: Composite fire and smoke hazard ratings shall not exceed 25 from flame spread and 50 for smoke developed.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming.

.3 Recovery Jackets: 0.9 mm (20 ga) smooth aluminum sheet for exterior duct work and where subject to damage.

.4 All insulation materials shall meet current Building Code Standards, and packages or containers of such materials shall be appropriately labelled.

2.2 Materials

.1 Exposed Rectangular Ducts: Rigid fibrous glass or mineral fibreboard insulation, "K" value maximum 0.035 W/m°C (0.25 BTUh-in/(sqft°F)) at 24°C (75°F).

.2 Acoustic Lining: Fibrous glass or mineral fibreboard insulation with "K" value maximum 0.035 W/m°C (0.25 BTUh-in/(sqft°F) at 24°C (75°F). Absolute roughness of exposed surface not to exceed 0.58 mm (0.02 in), coated to prevent fibre erosion at air velocities up to 25.4 m/s (5,000 fpm), 24 kg/m³ (1.5 lb/cuft) minimum density for ductwork and 75 kg/m³ (4.7 lb/cuft) for plenums. Substrate must not be dark in colour. Service temperature -40°C (-40°F) to 65°C (150°F).

3. EXECUTION

3.1 Preparation

.1 Do not install covering before ductwork and equipment has been tested and approved.

.2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions where possible.

3.2 Installation

.1 Ensure insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation materials, properly sealed.

.2 Finish insulation neatly at hangers, supports and other protrusions.

.3 Do not insulate ductwork with external thermal insulation where acoustic duct insulation is specified.

.4 Locate insulation or cover seams in least visible locations. Locate seams on ductwork in ceiling spaces on the underside of the duct.

.5 Provide recovering jackets on exposed insulation throughout. Make smooth any uneven insulated surface before recovering.

.6 Cover insulation exposed to outdoors with aluminum jacket secured with aluminum bands on 200 mm centers or screws on 150 mm centers. Lap joints 75 mm minimum and seal with compatible waterproof lap cement.

.7 Exposed Rectangular Ducts: Secure rigid insulation with galvanized anchors or welded pins on 400 mm centers. Secure in place with retaining pins. Seal all insulation joints and breaks with joint tape. Seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two (2) coats of lap seal adhesive.

.8 Acoustic Lining: Apply to interior of ducts where shown. Secure to ductwork with adhesive using 50% coverage and anchors or weld pins on 400 mm centers. Secure in place with retaining clips. Cut off excess fastener length and cover with brush coat of mastic over protrusions and all raw edges. Use 25 mm thick insulation unless otherwise noted. Provide vapour barrier located on the warm side for outside air intakes. Bevel corners at joints and butt together. Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.

3.3 Insulation Installation Thickness Schedule

Ducts		Insulation Thickness, mm	Recovery Jacket
.1	Inside Ducts	Matching Existing	
.2	Ducts and silencers Exposed to Outdoors	50	Aluminum
.3	Acoustic Lining	50	-

END OF SECTION

1. GENERAL

1.1 General Intent and related information

.1 The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Mechanical Division Sections for details.

.2 The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

.3 Provide all the hardware and software to accommodate existing control system.

1.2 Submittals

.1 Shop Drawings, Product Data, and Samples

.1 Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the City and Contract Administrator.

.2 Allow fifteen (15) working days for the review of each package by the Contract Administrator in the scheduling of the total work.

.3 At a minimum, submit the following:

.1 Systems schematics, sequences and flow diagrams.

.2 Points schedule for each point in the control system, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.

.3 Damper Operators are included actuator type, torques and maximum used damper size.

2. PRODUCTS

2.1 General Description

2.2 Input Devices

.1 General Requirements

.1 Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

.2 Status and Safety Switches

.1 Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the control system when a failure or abnormal condition occurs.

Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

.3 Air Flow Monitoring Stations

.1 Provide an air flow monitoring station on the return air and supply air ductwork as shown on drawings.

.2 Contractor shall make duct measurements to ensure proper fit of air flow sensors.

2.3 Output Devices

.1 Actuators

.1 General Requirements

.1 Damper actuators shall be electronic, as specified in the System Description section.

.2 Electronic Damper Actuators

.1 Electronic damper actuators shall be direct shaft mount.

.2 Modulating actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.

.3 Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

.4 Acceptable manufacturers: Johnson Controls, Mamac.

2.4 Variable Frequency Drive (VFD)

.1 Reuse existing return fan VFD.

3. PERFORMANCE/EXECUTION

3.1 Installation Practices

.1 Wiring

.1 All conduit, wiring, accessories and wiring connections required for the installation of the Control System, as herein specified, shall be provided by the Control Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.

.2 All control wiring materials and installation methods shall comply with control manufacturer recommendations.

.3 The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the control Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the control Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

.4 Class 2 Wiring

.1 All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.

.2 Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

.5 Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

.6 Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

.2 Penetrations

.1 Provide fire stopping for all penetrations used by dedicated CONTROL conduits and raceways.

.2 All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

.3 All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

.4 Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

.3 Control Identification Standards

.1 Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

.2 Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

.4 Control Panel Installation

.1 The control panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.

.2 The control contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

.5 Input Devices

.1 All Input devices shall be installed per the manufacturer recommendation

.2 Locate components of the control in accessible local control panels wherever possible.

.6 HVAC Input Devices – General

.1 All Input devices shall be installed per the manufacturer recommendation

.2 Locate components of the control in accessible local control panels wherever possible.

.7 HVAC Output Devices

.1 All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as dampers.

.8 Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke.

.9 VFD: Remove and reinstall existing return fan VFD by Division 26.

3.2 Commissioning

.1 Fully commission all aspects of the Control System work.

.2 Acceptance Check Sheet

.1 Prepare a check sheet that includes all points for all functions of the CONTROL as indicated on the point list included in this specification.

.2 Submit the check sheet to the Contract Administrator for approval

.3 The Contract Administrator will use the check sheet as the basis for acceptance with the CONTROL Contractor.

.3 Promptly rectify all listed deficiencies and submit to the Contract Administrator that this has been done.

END OF SECTION

CONTROLS POINTS LIST

1. GENERAL

.1 A point is a specific software address which is resident in the control system and which is identified with a particular field sensor, instrument or sensor.

.2 The point schedule contains a general list and description of the points to be connected. The Contractor shall examine the point schedule and ensure that all points required to make the described control sequences work are provided, whether included in the point schedule or not.

.3 The relationships between the points, systems and building are described in the control sequences, Section 23 09 93 - Sequence of Operations for HVAC Controls.

.4 Consult with the Contract Administrator during the Shop Drawing stage to finalise the physical terminal address of each point within the control system.

.5 The provided points list is not meant to be an exhaustive complete list of all points in the mechanical system. The Contractor is responsible for providing all required points for a fully functioning system.

2. CONTROLS POINTS LIST

.1 The following is the minimum required points for the building HVAC air system AHU-2.

Controls Points List For New Equipment				
Description	**Type**	**Value**	**Units**	**System**
AHU VFD Enable/disable	DO			Building HVAC
AHU VFD Alarm	DI			Building HVAC
AHU VFD Speed	AI		%	Building HVAC
AHU VFD Speed Control	AO			Building HVAC
Motorized Damper MD-1 Control	AO			Building HVAC
Motorized Damper MD-1 Position	AI		%	Building HVAC
Motorized Damper MD-2 Control	AO			Building HVAC
Motorized Damper MD-2 Position	AI		%	Building HVAC
Motorized Damper MD-3 Control	AO			Building HVAC
Motorized Damper MD-3 Position	AI		%	Building HVAC
Return Air Flow	AI		L/s	Building HVAC
Supply Air Flow	AI		L/s	Building HVAC

3. PRODUCTS

.1 Not Applicable.

4. EXECUTION

.1 Refer to Section 23 09 33 for input/output designations.

END OF SECTION

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

1. GENERAL

.1 The control sequences contain a general description of the intent of the operation of the systems to be controlled. The Contractor shall review individual systems to ensure equipment and life safety interlocks are not overridden.

.2 All set points and times of operation given in the control sequences are indicative. Final set points shall be dictated by site conditions.

.3 The relationships between the points, systems and building are described in the control sequences.

.4 Review with the Contract Administrator during the shop drawing stage to finalize the control sequences for the system.

.5 Supply and install all controls, wiring, and ancillaries required to provide the functionality described within this Section.

2. SCOPE

.1 Air Handling unit (AHU-2)

.2 Electrical Unit Heater (UH-1)

3. PRODUCTS (NOT USED)

4. EXECUTION

.1 Provide data base for all hardware points listed for system operation to meet Specification operating sequences.

5. CONTROL SEQUENCES

5.1 Air Handling Unit (AHU-2)

.1 Description of operation:

.1 AHU-2 provides return air and outside air for existing ventilation, cooling and heating system for renovated fourth floor at Millennium Library. The return air can be either be exhausted outside (MD-1) in response to room static pressure sensor (existing) or re-circulated back through MD-2 to the existing AHU-1.

.2 When air is being exhausted through MD-1, fresh outside air is proportionally pulled through MD-3.

.3 Refer to Drawing M04 Air Handling Unit Control schematic.

.2 Start-up:

.1 When AHU-2 is switched on the dampers shall operate as follows:

.1 Exhaust air damper MD-1 shall modulate open to respond to the existing room static pressure set point.

.2 Re-circulation bypass damper MD-2 shall modulate fully open to 100% minus MD-1 damper percentage.

.3 Outside air intake damper MD-3 shall modulate open the same percent of relief damper actuator.

.4 For Example:

.1 If MD-1 = 30%

.2 MD-2 = 100% - MD-1 = 70%

.3 MD-3 = MD-1 = 30%

.2 Position switches on the dampers shall prove the dampers have reached the required position.

.3 Initiate the start-up of the AHU-2 return fan VFD-2 to accommodate the existing AHU-1 supply fan.

.4 A failure to start return fan in the AHU-2 shall result in the shutdown of the power to AHU-2, close MD-1, MD-2 and MD-3 and generate an alarm to the system.

.3 System Shutdown:

.1 In the event AHU-2 experiences a manual shutdown, a motor failure, a VFD failure or a power failure, AHU-2 shall be shutdown, outside air damper fully opened, relief damper closed and recirculation bypass damper closed.

5.2 Electric Unit Heater UH-1 in Outside Air Section of AHU-2

.1 General Description/Normal Operation

.1 Wall mounted electric unit heater is installed in outside air section of AHU-2 to melt snow and maintain the temperature inside this section above the freezing. When the outside air damper is completely closed, UH-1 will operate to achieve the thermostat set point.

.2 The thermostat set point shall be field adjustable, but initially set to 2°C.

.3 The unit heater shall be de-energized when the outside air temperature is above 5°C.

END OF SECTION

METAL DUCTS

1. GENERAL

1.1 Scope

.1 Ductwork and plenums

.2 Fasteners

.3 Sealants

.4 Turning vanes

1.2 Definitions

.1 Low Pressure: static pressure in duct less than 500 Pa and velocities less than 5.6 m/s.

.2 Duct sizes shown on plans are inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.

1.3 Quality Assurance

.1 Ductwork shall meet the requirements of NFPA No. 90A - Air Conditioning and Ventilating Systems.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

.3 Flexible air duct shall conform to NFPA 90A and ULC 181 standard for factory made air duct materials and air duct connectors.

1.4 Alternatives

.1 Obtain written permission from the Contract Administrator prior to making variations in duct configuration or sizes. Size alternatives using ASHRAE table for circular equivalents of rectangular ducts.

2. PRODUCTS

2.1 Materials

.1 Ducts: galvanised steel lock forming quality, having galvanised coating of 380 g/m^2 (1.25 oz/ft^2) for both sides.

.2 Fasteners: use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts. Weld kitchen exhaust ducts.

.3 Sealant: water resistant, fire resistive, compatible with mating materials.

.4 Gauges as per SMACNA for pressure rating.

.5 Flexible Duct - Low Pressure: flexible air duct shall be used where shown on drawings. Length of flexible duct shall not exceed 900 mm. Flexible duct shall be polymetric liner banded to a steel wire helix, wrapped with fiberglass insulation and outer fiberglass reinforced metalled vapour barrier jacket. Flexible duct rated for 6.1m/s velocity and pressure rated for 500 Pa. positive and 500 Pa negative.

.1 Standard Acceptance: Thermaflex M-KE.

3. EXECUTION

3.1 Plenum Gauges

.1 Fabricate fan plenums and plenums downstream of fan in accordance with SMACNA manual.

.2 Fabricate plenums between fan and upstream apparatus of 1.6 mm (16 ga) thick material.

.3 Fabricate plenums between filters and upstream apparatus of 1.3 mm (18 ga) thick material.

3.2 Duct Sealing

.1 All supply, return and exhaust duct joints, longitudinal as well as transverse, should be sealed using:

.1 Low Pressure Ductwork:

.1 Slip Joints: apply heavy brush-on high pressure duct sealant. Apply second application after the first application has completely dried out. Where metal clearance exceeds 1.5 mm (0.06 inch) use heavy mastic type sealant.

.2 Flanged Joints: soft elastomer butyl or extruded form of sealant between flanges followed by an application of heavy brush-on high pressure duct sealant.

.3 Other Joints: heavy mastic type sealant.

.2 Duct tapes as sealing method are not permitted.

.3 Surfaces to receive sealant should be free from oil, dust, dirt, moisture, rust and other substances that inhibit or prevent bonding.

.4 Prior to sealing all ductwork, demonstrate sealing of a section of each type of duct and obtain approval from the Contract Administrator.

.5 Do not insulate any section of the ductwork until it has been inspected and approved of duct sealant application.

3.3 Installation

.1 Locate ducts with sufficient space around equipment to allow normal operation and maintenance activities.

.2 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.3 Shield ductwork from dust and construction material during construction. Clean any ductwork found to be dirty at no extra cost to the Contract.

.4 Do not use flexible duct to change direction.

.5 Prove that ductwork is substantially airtight before covering or concealing.

.6 Ensure ducts are free of debris and dust.

.7 Fabricate ductwork from field measurements and not from plans and shop drawings exclusively. Failure to do so will not constitute an extra to the Contract.

.8 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross brace for rigidity. Open corners are not acceptable.

.9 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.10 Construct tees, bends and elbows with radius of not less than 1-1/2 times width of cut on centre line. Where not possible and where rectangular elbows are specified, provide double wall air foil type turning vanes at a maximum spacing of 100 mm. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibreglass inside.

.11 Increase duct sizes gradually, not exceeding 15° divergence wherever possible. Maximum divergence upstream of equipment to be 30° and 45° convergence downstream.

.12 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled. Seal seams on fresh air and exhaust ducts watertight with mastic or low velocity duct sealant.

END OF SECTION

AIR DUCT ACCESSORIES

1. GENERAL

1.1 Scope

.1 Access doors.

.2 Flexible connections.

.3 Silencers

1.2 Quality Assurance

.1 Access doors shall be ULC labelled.

.2 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems. Fabricate in accordance with ASHRAE Handbooks and SMACNA Duct Manuals.

.3 Silencer manufacturer shall operate its own duct-to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with ASTM E-477-06a. The facility shall maintain NVLAP accreditation for the E477 test standard.

.4 Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.

1.3 Submittals

.1 Submit shop drawings of factory fabricated assemblies.

.2 The manufacturer shall supply certified test data for each scheduled silencer. The data shall include dynamic insertion loss, generated noise and pressure drop for forward or reverse flow, matching the project's air distribution system requirement. All ratings shall be conducted in the same facility and shall utilize the same silencer.

2. PRODUCTS

2.1 Duct Access Doors

.1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Duct access panels with screws are not acceptable. Install minimum 25 mm thick insulation with suitable sheet metal cover frame for insulated ductwork.

.2 Fabricated with two butt hinges and two sash locks for sizes up to 450 mm two hinges and two compression latches with outside and inside handles for sizes up to 600 mm x 1200 mm and an additional hinge for larger sizes.

2.2 Flexible Connections

.1 Fabricate of ULC approved neoprene coated flameproof glass fabric approximately 150 mm wide tightly crimped into metal edging strip and attached to ducting and equipment by screws or bolts at 150 mm intervals. Flexible connection airtight at 500 Pa (2 in wg).

2.3 Silencers

.1 Elbow Silencers: All elbow silencers models shall be constructed with an 18 gauge galvanized steel outer casing and 22 gauge galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48 inch shall have at least two half splitters and one full splitter.

.2 Acoustic Media: Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.

.3 Combustion Ratings: Silencer materials, including glass fiber shall have maximum combustion ratings as noted below when tested in accordance with ASTM E84, NFPA 255 or UL 723.

.1 Flame Spread Index: 15

.2 Smoke Developed Index: 5

.4 Construction:

.1 Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in “Section B Materials”, are minimums. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.

.2 Casings shall be lockformed and sealed, except as noted in Section B Materials, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.

.3 All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.

.5 Acoustic performance:

.1 Silencer dynamic insertion loss shall not be less than that listed in the silencer schedule.

.2 Silencer generated noise shall not be greater than that listed in the silencer schedule.

.3 Acoustic performance shall include dynamic insertion loss and generated noise for forward flow (air and noise in same direction) or reverse flow (air and noise in opposite direction) in accordance with the project's air distribution system requirements.

.4 All silencer ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with the ASTM E-477-06a test standard. The test set-up, procedure and facility shall eliminate all effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption.

.6 Aerodynamic performance: Silencer pressure drops shall not exceed those listed in the silencer schedule. Silencer pressure drop measurements shall be made in accordance with the ASTM E-477-06a test standard. Tests shall be conducted and reported on the identical units for which acoustical data is presented.

.7 Standard of Acceptance: Vibro-Acoustics

.8 Performance: Refer to Section 23 06 30.29 Silencer Schedule.

3. EXECUTION

3.1 Application

.1 Provide access door minimum 450 mm x 350 mm or 50 mm smaller than duct dimension for cleaning and inspection at positions indicated by drawings and as follows:

.1 Both sides of turning vanes in all ducts.

.2 Install ducts associated with fans and equipment subject to forced vibration with flexible connections, immediately adjacent to equipment and/or where indicated on drawing.

.3 Silencers shall be inserted a minimum of 50 mm into an external wall to minimize sound infiltration.

END OF SECTION

CUSTOM-PACKAGED, OUTDOOR, CENTRAL-STATION AIR HANDLING UNITS

1. GENERAL

1.1 Scope

.1 Outdoor air handling unit.

1.2 Quality Assurance

.1 It is the intent of this Specification that the Manufacturer provides air handling unit designed and manufactured specifically to the requirements of this Project. Overall dimensions and configuration are to be as shown on the plans and as described in the Specifications. Take responsibility for the engineering and operational integrity of the AHU.

.2 Comply with local and Provincial Regulations and have CSA and CGA approval stickers.

.3 All components shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

.4 Provide unit produced by a recognized Manufacturer who maintains a local service agency and parts stock.

.5 Air flow rates, pressure drops shall be the same or better than specified for alternate selections.

.6 Fans shall be AMCA certified.

.7 Provide motor with thermal overload protection. All motors shall be premium efficiency type, inverter duty (suitable for variable frequency drives (VFDs)).

.8 All components, paints and lining shall have a flame spread rating of not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50.

1.3 Submittals

.1 Submit Shop Drawing which shall include the following minimum information. Shop Drawings submitted without this information shall be automatically rejected. Refer to Section 23 05 01 clause 1.7 for Shop Drawing submittal.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit.

.3 Product Data:

.1 Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.

.2 Provide data of filter media, filter performance data, filter assembly, and filter frames.

.3 Provide manufacturer's installation instructions.

.4 Mass Distribution Drawings: Show point loads and recommended method of unit installation.

.5 Damper Shop Drawings.

.6 All installation instructions shall be submitted 2 weeks prior to equipment ship. Instruction lists as following:

.1 Equipment off-load and storage

.2 Multiple sections connection

.3 Equipment installation

.7 Provide four (4) copies of Operating and Maintenance (O&M) Manuals 2 weeks prior to project inspection.

2. PRODUCTS

2.1 Components

.1 AHU shall consist of, but not be limited to the following components:

.1 Return fan section comes with motor (Premium efficiency invertor duty).

.2 Exhaust section comes with motorized relief air damper.

.3 Re-circulation outside air mixing section comes with motorized re-circulation bypass air damper and motorized outside air intake damper.

.4 Unit configuration and dimensions as shown on mechanical drawings.

.2 Standard of Acceptance: McQuay 'Skyline' Air Handler

2.2 Fan

.1 Acceptable fan assembly shall be a single width, single inlet, class II, belt-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Copper lubrication lines shall be provided and extend from the bearings and attached with grease fittings to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of unit if removal is required. Provide access to motor, drive, and bearings through hinged access door.

.2 Entire fan assembly including fan scroll, wheel and motor to be integrally mounted on an inertia base and to be separated from unit casing with flexible connections and spring isolators. Isolators shall be a free standing spring with a static deflection of not less than 50 mm (2 inch).

.3 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be designed for service with an L-50 life of 200,000 hours and shall be a heavy duty pillow block, self-aligning, grease-lubricated ball or spherical roller bearing type.

.4 Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

.5 V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Fixed sheaves, matched belts, and drive rated based on motor horsepower. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor minimum shall be 1.1 S.F. for 1/4 HP – 7.5 HP, 1.3 S.F. for 10 HP and larger, calculated based on fan brake horsepower.

.6 Motor shall be 10 HP ODP type, premium efficiency and inverter duty for 575/3/60 with variable sheaves.

2.3 Cabinet

.1 Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketting is not allowed.

.2 Panels and access doors shall be constructed as a 50 mm nominal thick; thermally broken double wall assembly, injected with foam insulation with an R-value of not less than R-13.

.3 The outer panel shall be constructed of G60 painted galvanized steel.

.4 The inner liner shall be constructed of G90 galvanized steel.

.5 The floor plate shall be furnished with 3 mm thick aluminum tread plate.

.6 A sound baffle shall be secured to the inner liner of selected fan, plenum, access, and manual sections. It shall be constructed of G90 galvanized perforated steel filled with 3 pound per cubic foot density, neoprene coated, glass fiber insulation.

.7 Plenum section shall be provided and properly sized for inlet and/or discharge air flow. The plenum shall provide single or multiple openings as shown on drawings and project schedule.

.8 Economizer section shall be provided with right side outside air opening and end return air opening and no exhaust air opening with or without parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided when return and outside air dampers sized for full airflow. Return and outside air dampers of different sizes or very large dampers and exhaust dampers must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one

percent leakage at 500 Pa (2 inches) static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

2.4 Access Doors

.1 Provide hinged man sized access doors. Door construction to be the same as casing each complete with 250 mm diameter round wired glass viewing window. Provide minimum two (2) latches per door openable from both sides. Doors to be sealed with neoprene gasketting (foam gasketting not acceptable). Door hinge to be continuous stainless steel piano hinge. Door sizes to be 750 mm x 1800 mm or as limited by height of unit.

2.5 Marine Lights

.1 Provide one (1) marine type light with switch in each section having an access door. Wire power connection for all lights to one point for connection by Division 26.

2.6 Outside Air Intake

.1 Provide outside air intake hood galvanized 13 mm x 13 mm mesh bird screen.

.2 Colour and finish matching unit.

.3 Outside air intake section floor shall be sloped to lower point comes with floor drain.

2.7 Dampers

.1 Low leakage type dampers with hollow blades filled with extruded polyurethane insulation. Standard of acceptance: Tamco 9000 or approved equal in accordance with B6.

.2 Blades shall be minimum 12 gauge extruded aluminum. Blades shall be of air foil design, 150 mm side. Maximum blade length 1200 mm.

.3 Damper seals shall be designed for minimum air leakage by means of overlapping seals.

.4 Frames shall be minimum 12 gauge extruded aluminum channel with grooved inserts for vinyl seal.

.5 Install blade linkage hardware in frame out of air stream. Use cadmium plated steel hardware.

.6 All damper actuators shall be modulating type with spring return and shall be provided with limit switches to provide proof of open and closed positions

.7 Damper actuators/operators shall be supplied and installed by controls contractor.

2.8 Finish

.1 Entire exterior is to be painted with two (2) coats primer paint followed by minimum two (2) coats of exterior application of air dried enamel.

3. EXECUTION

3.1 Installation

.1 Unit is to be shipped in sections and assembled on Site. All sections shall be shrink wrapped to protect from water, dirt and road salt during shipping.

END OF SECTION

UNIT HEATERS

1. GENERAL

1.1 Scope

.1 Electrical unit heater

1.2 Quality Assurance

.1 Conform to requirements of CGA, CSA, Provincial and Municipal Codes and be CSA listed.

1.3 Submittals

.1 Provide Shop Drawings of unit heater, including controls wiring diagrams.

2. PRODUCTS

2.1 Electrical Unit Heaters

.1 Entire heater rated as NEMA type 4X.

.2 16 gauge stainless steel cabinet with stainless steel elements.

.3 Epoxy/polyester coated fan blades.

.4 Built-in explosion thermostat.

.5 Stainless steel wall mounting kit.

.6 Stainless steel temperature hi-limit

.7 Control circuit: 120 V.

3. EXECUTION

3.1 Preparation

.1 Prior to installation check final location with the Contract Administrator, if different from that indicated. Should deviations beyond allowable clearances arise, request and follow Contract Administrator’s directive.

.2 Install with sufficient clearance to permit performance of unit heater maintenance.

3.2 Installation

.1 Install in accordance with Manufacturer's written instructions.

3.3 Performance

.1 Refer to Section 23 06 80.13 Decentralized Unitary HVAC Equipment Schedule.

END OF SECTION

LOW -VOLTAGE ELECTRICAL DISTRIBUTION

1. SCOPE OF WORK

1.1 Demolition

.1 Remove existing Fan F-1 VFD, disconnect switch, and output filter from closet. Save for reuse.

.2 Remove cable from NMCC1 F-1 circuit breaker to F-1 VFD disconnect switch. Return cable to owner.

.3 Remove cable from F-1 VFD filter to F-1 fan motor. Return cable to owner.

1.2 Supply and Install

.1 VF Drive Connections:

.1 Reinstall previously removed VFD, disconnect switch, and filter. Install in 5th floor mechanical room on South West Wall. Mount all equipment on 19 mm plywood backboard.

.2 3C#10 Teck cable from circuit breaker F-1 in NMCC1 to VFD disconnect. Reconnect Disconnect switch, VFD power supply, and VFD filter.

.3 Supply and install 30 Amp NEMA 4X rated disconnect switch on exterior of air handling unit fan section.

.4 Run 3C#10 Teck cable from VFD filter to new 30 Amp disconnect switch.

.5 Run 3C#10 Teck cable from new disconnect switch to air handling unit fan motor.

.6 Remove “F-1” Labels from circuit breaker door, VFD and other devices.

.7 Install 25 mm x 75 mm Lamacoid label white lettering on black background with legend: “Air Handling Unit AHU-2”. Install in the following locations:

.1 Circuit Breaker Door in MCC

.2 VF Drive

.3 Disconnect Switches (both switches)

.4 VFD filter unit

.2 60 Amp Panelboard

.1 60 Amp Square D panelboard and breakers as shown in drawings. Mount on South West wall of 5th floor mechanical room.

.2 60 Amp 3 pole breaker in panelboard FA as shown in drawings.

.3 Run cable from 3 pole breaker in panelboard FA to new 60 Amp panelboard.

.4 Install GFIC weatherproof receptacle on exterior wall of AHU-2 fan section within 300 mm of door.

.5 Run cables from new 60 Amp panelboard to devices fed from panelboard, including unit heater, three lights, and GFIC receptacle.

.6 Label new circuit breaker in panelboard FA: “AHU-2 Auxiliary Panel FA-1”

.7 Label circuit breakers in new panel FA-1 as indicated on drawing.

END OF SECTION