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## **SPECIFICATIONS**

FOR

### **BUILDING ENVELOPE REPAIRS AND HVAC SYSTEM UPGRADE**

1300 SHEPPARD AVE W

TO

### **CITY OF TORONTO**

DATED

**APRIL 08, 2024**

### **ISSUED FOR TENDER**

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MCW Project No. 22241H

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## PART 1 - GENERAL

### 1.01 REFERENCES

- .1 General Conditions, Documents in Division 00 and Sections of Division 01, apply to Contract Documents including specification and drawings.
- .2 Refer to Owner's policies and procedures documents attached to end of Section entitled Owner's Procedures. Where requirements of Specification conflicts with requirements of Owner's policies and procedures documents, Owner's policies and procedures documents to take precedence, subject to requirements of local governing codes and authorities .

### 1.02 DEFINITIONS

- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply, install, start-up, test and commission complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, start-up, test and commission.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products and/or systems, and includes manufacturer's supply of any specialty ancillaries, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "barrier-free" – means when applied to a building and its facilities, that building and its facilities can be approached, entered and used by persons with physical or sensory disabilities in accordance with requirements of local governing building code.
- .8 "delete" or "remove" (and tenses of "delete" or "removed") – means to disconnect, make safe, remove obsolete materials including any back box and exposed piping and raceways; patch, and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions; and properly dispose of deleted products off site unless otherwise instructed by Consultant.
- .9 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally have the same meaning.
- .10 "authority having jurisdiction" and/or "AHJ" and/or "AHJs" and/or "governing authority" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to, and govern the work, and to which work must adhere.
- .11 "OSHA" and "OHS" - stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.
- .12 "General Trades Divisions" – refers to Divisions 02, 03, 04, 07, 08, 09, 31, 32 and other Divisions as specifically noted, and which work as defined in Specifications and/or drawings is responsibility of Prime Contractor, unless otherwise noted.

- .13 "Mechanical Trades" and/or "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .14 "Electrical Trades" and/or "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .15 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.
- .16 Wherever term "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
- .17 Wherever term "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product(s) referred to as "reviewed by", "to the satisfaction of", "submitted to", the Consultant.
- .18 Wherever "Drawings", and/or "Specifications" and/or "Drawings and Specifications" are referred to, it means "the Contract Documents in their entirety".
- .19 Wherever the term "Work" or "work" is used in the Contract Documents it means all equipment, permits, materials, labour and other services as may be necessary to provide a complete installation as described and detailed on the Drawings, the Specifications and other references in the Contract Documents.
- .20 "Basis of Design" refers the mechanical design inherent in the Contract Documents to establish a specific performance requirement and may refer to specific Equipment and/or Products that have been used to establish an energy performance benchmark, and/or space constraint, and/or structural load, and/or may refer to a specific equipment arrangement, and/or may refer to a particular operating sequence, and/or other similar consideration specific to the design.
- .21 "Acceptable Manufacturer", and/or "Standard of Acceptance", and/or "Alternative Manufacturer", "and/or Acceptable Alternative" and/or similar language that describes manufacturers other than the manufacturer used as the Basis of Design shall all have the same meaning throughout the Contract Documents. Acceptable Manufacturers may be used in the Work in lieu of the Basis of Design manufacturers subject to conditions stipulated elsewhere in the Contract Documents.
- .22 In the specifications, references such as, "shown on the Drawings," "specified", "scheduled", "called for", and the like, shall be deemed to include work required by the Contract Documents.
- .23 In the specifications, the expression "Trade(s)" is synonymous with subcontractor(s) if the context permits. The expression "All Trades" shall be deemed to include the Contractor.

### **1.03 DOCUMENTS**

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .3 Review Drawings and Specifications of each Division and where applicable, Code Consultants' reports.
- .4 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

- .5 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment, materials and connecting services. Drawings are intended to convey scope of work and do not show exact architectural and/or structural details.
- .6 Mechanical and Electrical Drawings are intended to convey scope of work and do not show architectural and structural details. Provide fittings, offsets, transformations and similar items required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.
- .7 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .8 Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities and performance. Singular may be read as plural and vice versa.
- .9 Starter/motor control centre (MCC), and variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of both Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements of Mechanical Divisions specifications and drawings, prior to Bid submission and confirm and coordinate exact scope of work and responsibility between Mechanical Divisions and Electrical Divisions.
- .10 Drawings and Specifications are prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.
- .11 When scale and date of Drawings are same, or when discrepancy exists within Specification, include most costly arrangement to take precedence.
- .12 In case of discrepancies or conflicts between Drawings and Specifications, Documents will govern in following order:
  - .1 Documents of a later date.
  - .2 Specification;
  - .3 Drawings of larger scale;
  - .4 Drawings of smaller scale;
- .13 Language of Documents is in many cases are written in imperative mode for brevity. Clauses containing instructions or directions are directed to the Prime Contractor.

#### **1.04 METRIC AND IMPERIAL MEASUREMENTS**

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this Section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application.
- .2 Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite.
- .3 Where significant discrepancies are found, immediately notify Consultant for direction.

#### **1.05 EXAMINATION OF BID DOCUMENTS AND SITE**

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Consultant in writing, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.



- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.
- .4 Commencement of the Work implies acceptance of surfaces and conditions. No claim for damages or resulting extra work will be accepted where such conditions were known, visible or reasonably inferable at the time of bidding.
- .5 Ascertain the location of any services buried in the structure prior to cutting and take protective measures.
- .6 The Owner or Consultant will not be liable for any difficulties encountered or expenses incurred resulting from any condition known, or visible, at the time of bidding.
- .7 Check and verify on site all dimensions details and measurements required for any part of the Work, which is to fit to or conform to work already installed.

**1.06 WORK STANDARDS**

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless noted otherwise, the edition adopted by and enforced by local governing authorities having jurisdiction at time of submission of Bids. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Consultant.
- .3 All work shall be in accordance with the latest edition of the Occupational Health and Safety Act and Regulations for Construction Projects in the Province of Ontario.
- .4 Perform all work in accordance with the latest edition of the Ontario Building Code (OBC) unless otherwise specified.
- .5 Work to meet or exceed the requirements of specified standards, codes, and referenced documents, the Fire Marshall, City Fire Prevention and Building Management.
- .6 Supplementary mandatory specifications and requirements to be used in conjunction with project include but are not limited to following:
  - .1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);
  - .2 Air Movement and Control Association (AMCA);
  - .3 American Iron and Steel Institute (AISI);
  - .4 Air Movement and Control Association (AMCA);
  - .5 American National Standards Institute (ANSI);
  - .6 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
  - .7 American Society of Mechanical Engineers (ASME);
  - .8 American Society of Testing and Materials (ASTM);
  - .9 American Water Works Association (AWWA);
  - .10 ANSI/ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings;
  - .11 Associated Air Balance Council (AABC);
  - .12 Building Industry Consulting Services, International (BICSI);
  - .13 Canadian Gas Association (CGA);
  - .14 Canadian General Standards Board (CGSB);

- .15 Canadian Standards Association (CSA);
  - .16 CSA C282, "Emergency Electrical Power Supply For Buildings";
  - .17 CSA Z432 Safeguarding of Machinery;
  - .18 CSA Z462, "Workplace Electrical Safety";
  - .19 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
  - .20 Electrical Safety Authority (ESA);
  - .21 Electronic Industries Association (EIA);
  - .22 Factory Mutual Global (FM Global);
  - .23 Illuminating Engineering Society (IES);
  - .24 Institute of Electrical and Electronic Engineers (IEEE);
  - .25 International Standards Organization (ISO);
  - .26 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
  - .27 National Building Code of Canada (NBC);
  - .28 National Plumbing Code of Canada (NPC);
  - .29 National Fire Code of Canada (NFC);
  - .30 National Electrical Manufacturers Association (NEMA);
  - .31 National Environmental Balancing Bureau (NEBB);
  - .32 National Fire Protection Association (NFPA);
  - .33 National Standards of Canada;
  - .34 NSF International;
  - .35 Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces";
  - .36 Occupational Health and Safety Act (OHSA);
  - .37 Ontario Building Code (OBC);
  - .38 Ontario Fire Code (OFC);
  - .39 Ontario Electrical Safety Code (OESC);
  - .40 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
  - .41 Technical Standards and Safety Authority (TSSA);
  - .42 Telecommunications Industry Association (TIA);
  - .43 Thermal Insulation Association of Canada (TIAC);
  - .44 Underwriters' Laboratories of Canada (ULC);
  - .45 Workplace Hazardous Materials Information System (WHMIS);
  - .46 Material Safety Data Sheets by product manufacturers;
  - .47 local utility inspection permits;
  - .48 Codes, standards, and regulations of local governing authorities having jurisdiction;
  - .49 additional codes and standards listed in Trade Specification Sections;
  - .50 Owner's standards.
- .7 Provide applicable requirements for barrier free access in accordance with latest edition of Ontario Building Code.

- .8 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
- .9 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions. Notify Consultant in writing of conflicts between Contract Documents and manufacturer's instructions.
- .10 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
- .11 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by Consultant at any time.
- .12 The Contractor's supervisor or foreman shall be identified prior to the commencement of construction. The supervisor or foreman shall be physically on site while any or all work is being undertaken by all trades. The foreman or supervisor shall not be changed without 70 hours written notice to the Owner and provided that the proposed foreman meets the Owner's approval.
- .13 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.
- .14 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .15 Properly protect equipment and materials on site from damage and defacement due to elements and work of trades, to satisfaction of Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.
- .16 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.
- .17 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.
- .18 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, storage, handling and disposal of hazardous materials, and regarding labelling and the provision of material safety data sheets.

**1.07 SUBMITTALS**

- .1 Within (5) five days after award of contract, the Contractor shall submit the following information for review:
  - .1 General Liability Insurance
  - .2 Bonding
  - .3 WSIB
  - .4 Schedule

**1.08 PERMITS, CERTIFICATES, APPROVALS AND FEES**

- .1 The Contractor shall pay all costs associated with, and be responsible for, obtaining all permits, tests, and certificates, including the building permit if required, as required by the local municipality.
- .2 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities.
- .3 The Contractor shall be responsible for filing and posting a "Notice of Project" as required by the Occupational Health and Safety Act and Regulations for Construction Projects.
- .4 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.
- .5 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .6 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.
- .7 Copies of inspection/approval certificates must also accompany any invoices and shall be sent to the Owner.
- .8 Submit required applications, shop drawings, electrical distribution system protection device coordination studies, and short circuit calculations, and any other information requested by local authority.
- .9 Where electromagnetic locks are provided whether by this scope of work, or by others, be responsible for obtaining and paying for required certificates of work with regards to such electromagnetic lock work.

**1.09 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS**

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or, structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Unless otherwise specified in Division 00 and 01, liability insurance requirements are as follows:
  - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
  - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty (30) days written notice;
  - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in Place of the Work;
  - .4 Retained consultants are to ascertain that sub-consultants employed by them carry insurance in form and limits specified above;
  - .5 evidence of required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

### **1.10 WHMIS REQUIREMENTS**

- .1 Be familiar with Workplace Hazardous Materials Information System (WHMIS), which require uniform labelling of Hazardous Workplace Materials and Safety Data Sheets relating to materials covered in this Specification. Ensure that Employees and Subcontractors representing their firm who work with, or in proximity to, hazardous materials fully understand potential hazards and have been thoroughly trained to deal with any emergencies. Workers to be able to:
  - .1 recognize and understand labelling on hazardous materials;
  - .2 understand Material Safety Data Sheets, and are knowledgeable on how to safely use, store, handle and dispose of hazardous materials.
- .2 Ensure Material Safety Data sheets pertinent to completion of this project are on site.

### **1.11 WORKPLACE SAFETY AND PROCEDURES**

- .1 In addition to requirements of Instructions to Bidders, local governing Occupational Health, and Safety Act for Construction Projects, requirements of Owner's Occupational Health and Safety Policy, Safety Act and Instructions for Contractors document apply to the Work of this contract. Health and safety legislation from authorities having jurisdiction are to also apply to this project. Coordinate with Owner's occupational health and safety joint policy committee member, and review responsibilities of each party. Be responsible for ensuring that Subcontractors and Workers abide by rules and requirements set forth under the Act.
- .2 Be the liaison with Ministry of Labour and to notify Consultant of and enforce duties of Contractor (Constructor) in accordance with Occupational Health and Safety Act (Ontario).
- .3 When working in areas considered by governing authorities and local governing codes as being confined spaces, such as crawl spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632 "Confined Spaces" and any other applicable Ministry of Labour requirements.
- .4 Hot Work:
  - .1 Hot Work includes, but is not limited to, brazing, cuttings, grinding, soldering, pipe thawing, torch applied roofing, and welding operations.
  - .2 Prior to commencement of any Hot Work, for any temporary operations involving open flames or projecting sparks, Contractor's policies and procedures to be submitted to Consultant for review.
  - .3 No Hot Work is permitted without authorization of Owner; review work and protection methods with Consultant.
  - .4 Provide fire and public safety protection materials, screens, smoke eaters, etc. as may be required by type of work and Consultant.

### **1.12 WHMIS:**

- .1 Provide verification of having WHMIS training. Forward unexpired Material Safety Data Sheets for hazardous materials being brought onto site by Contractors, to Consultant who will forward them to Owner's Occupational Health and Safety Specialist. Notify Consultant prior to delivery and starting of any work involving use of hazardous substances.

### **1.13 FIRST AID:**

- .1 Be familiar with location of nearest first aid unit (provided by Contractor) prior to commencement of Work. Report incidents to Consultant immediately and submit a copy of Ministry of Labour report form to Consultant.

### **1.14 CONTRACTOR'S JOB SITE RULES**

- .1 Within ten (10) days of preconstruction meeting, and prior to commencement of Work, submit Contractor's job site rules, including safety policies and procedures, general safety policies and

injured worker transportation policies. These job site rules to be consistent with Contractor's duties and obligations under Contract and under Occupational Health and Safety Act. Such job site rules to include provisions making smoking and consumption of alcohol or non-prescription drugs on Project to be subject to discipline proceedings and/or termination of employment.

#### 1.15 SAFETY APPAREL:

- .1 Unless otherwise coordinated with Consultant, provide minimum 6 spare safety helmets for visitors. Enforce use of safety helmets and safety footwear for personnel, including visitors.
- .2 Follow requirements of local governing Occupational Health and Safety Act.
- .3 Assess potential workplace hazards on an on-going basis, particularly in situations of on-going construction of work, or where multiple trades are present and intermingling, or where workplace environment is not familiar.
- .4 Prior to start of work, provide to Consultant written confirmation that Contractor's personnel on site including sub-trades have been trained on safety policy and procedures and are aware of potential workplace hazards.
- .5 With due diligence, provide adequate levels of safety supervision, including sufficient and competent supervising staff and processes for monitoring compliance of safety requirements and to effectively communicate and inform personnel of any foreseeable risks or hazards prior to work commencing and regularly during progress of work.
- .6 Conduct regular site meetings as work proceeds, to organize work, explain safety aspects of work, remind of important safety aspects of work and to advise of any new hazards or problematic issues.

#### 1.16 DESIGNATED MATERIALS

- .1 If at any time during course of existing building work, hazardous materials other than those identified in Project Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without coordination with Consultant.

#### 1.17 WORK SCHEDULE

- .1 Project Start Date:
  - .1 The proposed project start timeline is as indicated by the Bidder in Bid Submission
- .2 Project Completion Date:
  - .1 The required substantial performance date is **November 1, 2024**.
- .3 Project Schedule:
  - .1 The successful bidder must provide a project schedule within 5 (five) days of project award. An updated project schedule must be submitted every two (2) weeks. Payment will not be certified without submission of an updated project schedule.
  - .2 As outlined in Document entitled Instructions to Bidders, after award of contract, submit detailed work programme schedule of sequence of work, identifying date for each step of work, methodology of how work is to be performed, when deliveries are to be made and interruption to services requirements. Prepare submitted schedule based on conceptual schedules and requirements in Document entitled Instructions to Bidders. Such schedule to identify a complete breakdown of project activities showing time duration of each activity. Strictly adhere to schedule. Do not start any construction work without Consultant's review of schedule and coordination with Consultant. Project schedule updates must contain a four

(4) week look ahead for expected interruptions for owner operations in upcoming areas of work.

- .4 Working Hours:
  - .1 General: Monday to Friday, 8:30 AM to 6:30 PM.
  - .2 Noisy Work to be completed within applicable by-laws and coordinated with building staff. Any shut downs to areas of the building are to be arranged for after hours.
  - .3 All work to be in accordance with applicable by-laws.
  - .4 All work must be coordinated with the Owner.
- .5 Use scheduling program acceptable to Owner.
- .6 Contractor's Construction Superintendent to attend regular weekly site meetings with Owner's representative to review project work and to report on progress. Contractor's site representative to prepare notes of meeting and issue to participants within three (3) working days after meeting. Prepare a Project Status report and issue to Consultant on every Monday during construction phase unless Monday is a statutory or provincial holiday, then on next working day. Project Status report to summarize activities completed in prior week, and forecast activities to be undertaken in current week.
- .7 Include for scheduling, coordination and work phasing to suit project requirements. No extras for premium time will be considered. Shutdowns and planning of operations that may affect Owner's use of services to be coordinated and approved in writing with Owner and reviewed by Consultant.
- .8 Be aware that on-going functions of existing building must continue and noise-making tools may be operated only with Owner's permission and review by Consultant. Owner or Owner's representative may at any given time request that any construction activity be temporarily ceased due to interference being caused.
- .9 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, co-ordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and as agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium time work to meet these requirements.
- .10 Owner reserves right to perform additional non-related work in same space, while Contractor is performing their work.
- .11 Review product delivery times with suppliers/manufacturers proposed at time of Bid and reviewed with Consultant and ensure that products are delivered within time frames to meet work schedule requirements. Failure to order products in time to meet work schedule unless due to named manufacturer's unforeseen circumstances, is not acceptable reason to change from named manufacturer.

#### **1.18 PLANNING AND LAYOUT OF WORK**

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
  - .1 piping requiring uniform pitch;
  - .2 piping 100 mm (4") dia. and larger;
  - .3 large ducts (main runs);
  - .4 cable tray and bus duct;

- .5 conduit 100 mm (4") dia. and larger;
- .6 piping less than 100 mm (4") dia.;
- .7 smaller branch ductwork;
- .8 conduit less than 100 mm (4") dia.
- .3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .4 Do not use Contract Drawing measurements for prefabrication and layout of raceways, conduits, ducts, bus ducts, luminaires, layout of piping, sheet metal work, and other such work. Locations and routing are to be generally in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼" =1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review.
- .6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .7 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.
- .8 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .9 As reviewed with Consultant, Mechanical Contractor is to determine final locations of major work within ceiling spaces.
- .10 Control products, products requiring maintenance, junction boxes, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .11 Where drawings indicate that acoustic tile ceiling is being suspended below plaster ceiling, coordinate design of framework used to support suspended ceiling, lighting, diffusers, and other Divisions components that are mounted within or through ceiling. Do not mount devices to suspended ceiling. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.

#### **1.19 PHASING**

- .1 The animal shelter will remain open and operational throughout the work.



- .2 The safety of staff and animals in the shelter is of the highest importance. Temporary relocation of staff and animals within specific rooms of the shelter to facilitate necessary work can be arranged given adequate notice.
- .3 Mobilization space to be set up to permit continuous traffic flow to the shipping and receiving area of the shelter at all times.
- .4 Contractor to provide interior and exterior signage to identify work areas and staff/pedestrian access throughout the project.
- .5 Within one (1) week of Contract award, the Contractor must provide a phasing plan which includes a map showing fence lines, planned timelines for different areas of work, arrows showing traffic flow, sign locations and text, and schedule.
- .6 Proposed phasing of the mechanical and building envelope scope of work is as follows, subject to change by the awarded Contractor and project stakeholders:
  - .1 Building envelope exploratory work is to be completed first prior to the rest of the building envelope scope. The building envelope repairs are to prioritize completion of the metal clad wall type 1 rebuild in the courtyard. All other envelope scope should be scheduled and phased to coordinate with animal shelter staff and mechanical and electrical scope.
  - .2 Mechanical and electrical scope to be phased according to proposed areas of work as indicated within the mechanical drawings. Deviations to this proposed phasing must be approved by Owner and Consultant.
- .7 Include for scheduling, co-ordination, and construction phasing to suit project time line for Completion. Review exact phasing requirements with Consultant prior to start of Work.
- .8 Phasing and scheduling of Work is required in order to maintain existing building operations. Include costs (including costs for "off hours" work) for scheduling, co-ordination, and construction phasing to suit this project as specified in Division 01 and on drawings. Review exact phasing requirements with Consultant prior to start of Work.
- .9 Project partial occupancy permits may be required throughout project. Where applicable, provide for each partial permit, local governing authority certificate and any other testing/verification certificates for systems.

#### **1.20 INTERRUPTIONS TO AND SHUTDOWNS OF SERVICES AND SYSTEMS**

- .1 It is understood that this facility is a critical facility that operates continuously. Avoid as much as possible, requirement for power or service shut downs. Take necessary steps and measures to avoid any need for shut down or service interruptions.
- .2 Coordinate shutdowns and interruptions to existing systems and services fully with and performed at times acceptable to Owner. Within ten (10) days of being awarded Contract, prepare and submit to Consultant, schedule and shutdown period(s) proposed. Ensure that Consultant reviews and Owner approves proposed schedules and interrupted services prior to start of Work. Include for performing Work during these times. No additional costs for overtime or premium time will be considered. Be fully responsible for ensuring that power to facility is restored once allowable window for shutdown has expired.
- .3 Prior to each shut-down or interruption, inform Consultant in writing minimum fifteen (15) working days in advance of proposed shutdown or interruption and obtain a written approval from Owner to proceed. Additionally, submit to Consultant for review, method of procedure (MOP) for each scheduled shutdown or interruption. Provide further additional notice in special cases with respect to services to essential systems. Exact requirements to be confirmed with Consultant. Do not shutdown or interrupt any system or service without Consultant's review and Owner approval. Owner retains right to cancel or re-schedule any period of shut down.
- .4 Perform work associated with shutdowns and interruptions as continuous operations to minimize shutdown time and to reinstate systems as soon as possible, and, prior to any shutdown, ensure

- that required materials and labour required to complete Work for which shutdown is required are available at onsite.
- .5 Coordinate with Owner any off-hour work and comply with any instructions given by Owner for carrying out this work. Such disruptive work consists of, but is not limited to power shut down, use of heavy equipment, use of explosive actuated tools, excessive noise of any origin, use of materials with odours, coring, drilling, and similar types of irritations.
  - .6 Owner retains right to shutdown services or building access for emergency reasons with no advance notification to Contractor. Owner to provide Contractor with minimum five (5) working days advance notice of planned temporary stoppages of services and planned rerouting of building access.
  - .7 Existing building to remain in use and occupancy throughout duration of construction of Work. Provide and maintain continuation of fire protection, fire walls and fire rated assemblies in existing building.
  - .8 Maintain existing exits and provide proper and safe means of egress from throughout existing building to open spaces at all times to approval of local governing authorities. Identify and provide exit lights, and illuminate temporary means of egress.
  - .9 Maintain access to service and delivery entrances, and for maintenance and inspection services.
  - .10 Maintain security of existing building during Work.
  - .11 Confirm with Consultant if any feeder is designated for special considerations and if designated as such and is to be interrupted, ensure that at least following preparations are met:
    - .1 provide a schedule of proposed feeders to be interrupted; propose one feeder at a time to be worked on per scheduled shutdown;
    - .2 provide a method of procedure for work;
    - .3 prepare above documentation and submit for review by Consultant at least 15 working days prior to date of each proposed work;
    - .4 on day/night of proposed feeder work, advise Consultant of which feeder is to be worked on; confirm with Consultant requirements for witnessing work;
    - .5 de-energize feeders and perform work as per Consultant and Owner reviewed schedule;
    - .6 after feeders are re-routed, megger test each feeder.
  - .12 Where working in close proximity to "live parts" or inside energized panels or energized cubicles of switchboards/substations, provide protection "boots" over bussing and insulating mats to cover areas of exposed live parts. Provisions to be in compliance with local governing authority requirements.
  - .13 Coordinate fully with Owner's designated personnel to maintain building services and life/safety systems in areas that are and may be in operation during construction of Project. Monitoring and supervision of existing life safety systems serving areas of Work, to be daily monitored to ensure that life safety systems are left in proper operating condition at end of each working day. Include for but not be limited to performing following:
    - .1 under presence of Owner's representative, check each morning and evening (start and end of work) of each day, each life safety and security system to ensure that they are in proper working condition;
    - .2 determine nature and exact locations of existing fire and smoke sensors prior to the commencement of the Work. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.
    - .3 if portions of life safety systems are not in proper working order, provide temporary provisions subject to approval of local governing authority having jurisdiction, to ensure that

- proper life safety alarm coverage is provided and/or provide supervisory personnel to monitor areas where life safety system is not operational during work;
- .4 document and sign off with Owner's representative signing off also, each respective daily check condition.
- .5 be responsible for costs incurred by Owner on account of false fire alarms activated as a result of the execution of the Work without adequate precautions.
- .14 Work Noise Levels: Execute Work as quietly as possible in and around existing building at times Owner is occupying it. Schedule noisy operations defined by Owner/Consultant, with Consultant to achieve least disturbance to Owner. In event of excessive noise or vibration being detrimental to function of building, at no cost to Owner, cease activity immediately upon notification from Owner and reschedule Work at a time suitable to Owner, changing tools and work methods, if required, to achieve desired results. In some situations Consultant may request that Contractor perform work of high noise levels on an intermittent basis (i.e. 1 hour on, 1 hour off).
- .15 At regular meetings, review areas of existing building that Contractor requires access in next 4 weeks, duration of time that areas need to be accessed, route of entry, times that entry is permitted and any other condition relevant to area of Work.

### **1.21 COORDINATION OF WORK**

- .1 The entire project will require strict coordination with the building operation staff and tenants.
- .2 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:
  - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
  - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
  - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
  - .4 wiring work required for equipment and systems but not specified to be done as part of specific particular trade work, including termination points, wiring type and size, and any other requirements.
- .3 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .4 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building subject to available space as confirmed with Owner and protected from elements.
- .5 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .6 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.
- .7 It is conceivable that a scheduled unit replacement can be altered the same day due to unanticipated tenant requirements or building operations. The contractor is to be prepared with alternate unit replacement so as not to lose production days.

### **1.22 COMPONENT FINAL LOCATIONS**

- .1 Owner and Consultant reserve right to relocate electrical components such as receptacles, switches, communication system, outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Owner, if relocation per components do not exceed 3m (10ft.) from original location. No credits will be anticipated where relocation per components of up to and including 3m (10ft.) reduces materials, products and labour. Should relocations exceed 3m (10ft.) from original location, adjust contract price for that portion beyond 3m (10ft.) in accordance with provisions for changes in Contract Documents.

### 1.23 SYSTEMS COORDINATION

- .1 Be responsible for and perform specific coordination of various low voltage systems supplied by Electrical Divisions and also with systems supplied by other Divisions of Work. Include for but not be limited to provision of following, as applicable:
  - .1 coordinate with General Contractor and other Subcontractors, various systems of trades which in any way are interfaced with or monitored by or integrated to, or need to be coordinated with;
  - .2 prepare systems coordination drawings detailing related system coordination and integration points being monitored and/or controlled; submit coordination drawings as part of shop drawing submission;
  - .3 coordinate security system requirements with successful door hardware supplier and prepare detailed coordination drawings of component installations, wiring and conduit layouts, division of responsibility between various trades, etc.; review security system requirements with associated door hardware (electromagnetic locks, electric strikes, etc.), to ensure proper sequence of operation and door functionality is provided to suit each door configuration; prepare detailed door functionality of each door configuration and submit for review by Consultant;
  - .4 review systems requirements for component back boxes and conduits; ensure that system of conduits and boxes meet respective system wiring bending radii requirements;
  - .5 review specifications of each trade/Division (i.e. for BAS points, elevator requirements, electrical devices in millwork or prefabricated service consoles, outlet box and back box requirements), to ensure proper power supplies, interconnecting wiring requirements and back box/ outlet box requirements;
  - .6 review with manufacturers coordination and integration requirements of their systems;
  - .7 review each systems communication protocols to ensure they are compatible and can communicate with each other as required;
  - .8 review system shop drawings prior to submission to Consultant, to verify that each system has been coordinated with other systems and that required options and features are selected to meet coordination requirements;
  - .9 be present at testing and commissioning functions of each system and provide technical assistance with regards to system operations;
  - .10 be "on-site" coordinator of respective system trades with regards to respective system coordination of installation and testing;
  - .11 coordinate and review with Consultant with regards to ensuring that systems coordinate and integrate properly to satisfaction of Owner;
  - .12 document coordination and integration requirements and maintain records for submission as part of shop drawings;
  - .13 respond to coordination and integration requirements and be responsible for such work;
  - .14 where a system integrator has been included for, coordinate integration requirements with system integrator.

## **1.24 PRODUCTS**

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted.
- .3 Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada.
- .4 Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable.
- .5 Do not supply any products containing asbestos materials or PCB materials.
- .6 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .7 Products scheduled and/or specified have been selected to establish a performance and quality standard, and also a dimensional standard, and a dead load/ live load standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product provided all selection criteria is achieved. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.
- .8 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specified selection criteria, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions.
- .9 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications and selection criteria included herein.
- .10 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, and similar downstream effects), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces and equipment supports where equipment named as acceptable is used in lieu of base specified equipment. Where dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment

- to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .11 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other selection criteria requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form.
- .12 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other selection criteria requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.
- .13 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional increase to the Contract amount.
- .14 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of ten (10) working days prior to Bid closing date.
- .15 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if accepted by Consultant, and costs for review, to be borne by Contractor.
- .16 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.
- .17 Requirements for low voltage systems of this project that are of technology that changes rapidly and are forever evolving and changing, resulting in systems that may be out dated by time of installation, are to include provisions to allow Owner option to select most updated technology. Shop drawings for such systems and equipment are to include provisions for a minimum six (6) week review time for Owner to review degree of technology of each system and determine acceptance. Owner will have right to substitute a more advanced technology subject to negotiated pricing.

## 1.25 NON-FERROUS MATERIALS

- .1 Materials within designated imaging rooms to be of non-ferrous construction as reviewed with Consultant. Devices, luminaires, various communications system components, and similar devices, utilized to be approved for use in designated imaging room type applications. Methods of construction to take into consideration use of non-ferrous materials. Ultimate approval of any materials, devices or components, or methods of construction to be at imaging system

manufacturer's discretion. Coordinate and confirm final requirements with successful imaging system supplier.

#### 1.26 SITE SECURITY

- .1 Unless otherwise instructed by Owner, Contractor and Subcontractors are required to sign-in at security desk on a daily basis. Sign-out at security desk prior to leaving site at end of each Working Day.
- .2 As confirmed with Owner, Contractor may be given a limited number of security badges to distribute to Contractor's staff and to Subcontractors. Provide Owner with a continually updated list of Subcontractors that are working at Place of the Work.
- .3 Contractor, workers, and other project personnel are only to access specific areas of work via entrances and routing shown and as confirmed and reviewed by the Consultant and approved by the Owner.
- .4 Contractor supervision must be present on site during any work being performed as part of this Project.

#### 1.27 TEMPORARY FACILITIES AND SERVICES

- .1 Means and methods of construction are completely and solely the responsibility of the Contractor. Cost of all temporary works to be included in the Contract Price.
- .2 The Contractor shall provide all temporary works to facilitate construction. Contractor to design, erect, maintain, remove and assume full responsibility for temporary works require for the safe and complete execution of the Work.
- .3 Access of heavy construction equipment and accumulation of construction materials on the floors are not permitted unless the Contractor has provided engineered load checks, due diligence site investigation and whatever else the Owner and Consultant deem required.
- .4 Submit shop drawings for all temporary works for review before fabrication commence. Shop drawings shall be sealed by a professional engineer registered in the Province of Ontario.
- .5 Provide temporary facilities as required for:
  - .1 construction office as coordinated with Owner and reviewed with Consultant;
  - .2 first aid: as required by local governing authorities;
  - .3 fire protection: as required by local governing authorities and as per Owner's policies and procedures;
  - .4 ventilation: do not use hazardous materials without approval of Owner and review by Consultant; for applications requiring ventilation, provide mechanical ventilation to satisfaction of Owner and as per local governing authority requirements;
  - .5 dust and debris containment: provide temporary dust and debris containment requirements as specified elsewhere in this Section.
- .6 Sanitary facilities are not available on site for use by the Contractor. Provide temporary stand-alone facilities in locations as coordinated with Owner.
- .7 Electrical power supply is not available onsite- Contractor to supply all power.
- .8 Throughout duration of project, water may be taken from existing services in building, as approved by Owner and reviewed with Consultant. Confirm power connection points with Owner and review with Consultant. Only amount of water required for normal and proper execution of work may be used. Pay for unusual or unwarranted consumption of water. Decision of Consultant on this matter will be final and binding. Building to remain totally operational during regular hours.

#### 1.28 RESPONSIBILITY FOR TEMPORARY STRUCTURES

- .1 Take precautions to prevent the overloading of scaffolding, and other temporary structures. Make good, at own expense, any damage resulting from such overloading.
- .2 Make good all areas affected by the use of any and all temporary structures.

**1.29 STORAGE AND HANDLING OF MATERIALS**

- .1 Do not encumber the site with materials or equipment. Maintain full entry and exit facilities at all times. Keep all existing egress routes free from materials, equipment and obstructions of all kinds.
- .2 Coordinate storage requirements for project material/equipment in advance, and store material/equipment in accordance with Owner's instructions and space restrictions. For storage of materials/equipment in excess of building space requirements, be responsible for arranging own means of material/equipment storage, to approval of Owner and reviewed with Consultant.
- .3 Store, materials to be reused, recycled and salvaged in locations as directed by Owner and reviewed with Consultant.
- .4 Unless specified otherwise, materials for removal and not being reused become Contractor's property and to be properly disposed off-site.
- .5 Protect, stockpile, store and catalogue salvaged items.

**1.30 WASTE MANAGEMENT**

- .1 Audit, separate and dispose of construction waste in whole or in part, in accordance with Ontario Regulations 102 and 103 made under Environmental Protection Act.
- .2 Develop a Construction Waste Management Plan, outlining what waste materials are expected, and how waste will be diverted away from landfill. Identify in the Plan appropriate unused material handling and disposal protocols, recycling opportunities and manufacturer take-back programs. During regular periods reviewed with Consultant, submit copies of waste hauling certificates or receipts with documentation of recovery rates for all materials where a portion is recycled and/or reused and a portion is landfilled.
- .3 Implement Construction Waste Management Plan and document how plan was followed during construction.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Separate and store materials produced during dismantling of structures in designated areas.
- .6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
- .7 Fires and burning of rubbish or waste onsite is prohibited.
- .8 Do not bury rubbish or waste materials.
- .9 Do not dispose of waste into waterways, storm, or sanitary sewers.
- .10 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .11 Empty waste containers on a regular basis.

**1.31 PARKING AND TRAFFIC CONTROL**

- .1 Arrange for own parking outside of site. Limited parking may be available onsite, but confirm availability with Owner.
- .2 Control traffic to and from Place of the Work to public roads where public pedestrian and vehicular traffic occurs. Conform to local traffic regulations, parking authority and police instructions.
- .3 Where work requires closure of public roads, sidewalks, and/or use of properties/spaces of adjacent buildings/lots, include necessary arrangements and costs to obtain approvals for such use, from



respective authorities and/or Owners/Property Managers. Include for required police supervision, where applicable.

### **1.32 PROTECTION AND SECURITY**

- .1 The building will remain in full operation during the execution of the Work.
- .2 All protection barriers, pedestrian control measures, signage, temporary lighting, dust control, odour control, noise control, protection of building elements (such as exterior wall cladding, interior finishes etc.) etc., shall be inclusive to the contract and no further or separate payment shall be made.
- .3 The Contractor is solely responsible for the safety and security of the construction site. Protect existing services, structures and other items required to remain and newly installed Work during construction with secure and durable coverings, barricades, or guards suitable for various conditions. Perform Work in a manner to avoid damage. The Contractor is solely responsible for any damages or such claim for damages as a direct or indirect result of their operations.
- .4 The Contractor is responsible for all damage to the interior finishes, cladding, roofing structure, landscaping (shrubs, bushes, grass, sidewalks etc.), as a result of the Work. The Contractor shall rectify any damages as part of the Base Bid.
- .5 No destructive temporary protection, hoarding, traffic flow, etc, measures can impact the structure, waterproofing systems, etc. Contractor is responsible for including non-destructive methods in their cost.
- .6 Owner's personnel and public will be occupying existing building during execution of Work. Provide for safety of occupants and for security of occupied areas. Provide protection and keep clear areas that are required for access to, and exit from, occupied areas. Maintain clear and safe fire exit routes.
- .7 Protect existing areas above, below and adjacent areas of Work from any debris, noise or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain existing services to these areas in operation to allow Owner to have continued use of areas. If services that are required to be maintained and run through areas of renovations, provide necessary protection to services or reroute, to approval of Owner and reviewed with Consultant. Include for required premium time work to meet these requirements.
- .8 Where construction operations are executed or traffic routed over finished floors, lay minimum 6 mm (1/4") thick plywood coverings tightly fitted over surface in such areas. Secure plywood to prevent movement in a manner which will not damage finished surfaces.
- .9 Cover openings in equipment, ducts, and pipes until final connections are made.
- .10 Protect exposed live electrical equipment during construction for personal safety.
- .11 Shield and mark live electrical parts with appropriate warnings.
- .12 Wherever practical, barricade and lock finished areas.
- .13 Ensure continuous security of Work and construction equipment.
- .14 Perform special precautions when using ladders. As one worker is on a ladder, position another worker at bottom of ladder to maintain watch and to, secure/support ladder. Erect a safety barrier as required around ladder.
- .15 Provide rigid structural safety barriers in compliance with safety requirements of local governing authority having jurisdiction, around perimeter of excavation work. Provide proper warning signage.
- .16 Properly secure tools and Products at end of each Working Day. Owner will not be held responsible for any material/Product losses and/or theft.
- .17 Do not permit public access to the construction area or to areas immediately below or adjacent to work areas.

- .18 Do not exceed the safe live load capacity due to loads from equipment, materials, and the like, without the areas being adequately shored. Wherever possible, materials to be stored on grade. As a minimum, the contractor must include for an engineered letter and drawing confirming allowable material, equipment, etc., loads allowed during construction. Letter must be provided prior to mobilization.

### 1.33 NOISE AND WIND PROTECTION

- .1 Provide full co-operation and protective measures in minimizing excessive noise due to construction operations.
- .2 No pneumatic tools and other excessively noisy and disrupting tools, machinery and equipment to be permitted without written approval of Owner and review with Consultant.
- .3 Do not store materials on roofs or other areas of site which could be subject to falling from building, as a result of winds or otherwise, which might result in damage to property or risk to public safety.
- .4 Ensure that temporary construction materials and structures are securely fastened to structure or ground to prevent falling or blowing off building or ground and causing harm to persons or property.
- .5 Promptly remove any temporary structures and materials from roofs as soon as possible.
- .6 Conduct a daily review of site to ensure that materials and temporary structures are secure. Allow for inspection by Consultant. Rectify any deficiencies as instructed by Consultant.
- .7 Prior to issuance of a Certificate of Substantial Performance of the Work, review roof or other areas of site with Owner and Consultant to ensure that temporary construction materials and structures are removed. Submit to Consultant, final field review report stating that roof or other site areas are cleared of temporary construction materials and structures. Certificate of Substantial Performance of the Work is not to be granted until Consultant reviews condition of site to be satisfactory.

### 1.34 HOARDING AND FENCING

- .1 Provide required hoarding, fencing, safety devices, and safety barriers, and provide required temporary safety rails, and weather tight and/or protective covers, and other measures necessary to protect building occupants, works, building elements, and the site. Comply with Occupational Health and Safety Acts and maintain same in a safe condition until total completion of this Contract or until directed by Consultant, whichever is sooner. Safety rails, weather tight and/or protective covers, and other measures necessary to be provided around excavations, concrete floor edges, perimeters of slabs, openings, stairwells, and similar instances where falls may occur. Provide fencing and/or hoarding around construction areas and staging areas in compliance with local governing authority and code requirements. Remove safety barriers at completion of work as coordinated with Consultant.

### 1.35 FENCING:

- .1 Provide galvanized steel fencing positioned to provide a secured compound area for area and/or equipment as noted on drawings. Materials include but are not limited to provision of following:
  - .1 terminal posts, line posts and post caps; posts spacing to be maximum 3m (10ft.);
  - .2 rails;
  - .3 offset bands and centre bands;
  - .4 tension bars and wires;
  - .5 fence ties;
  - .6 chain link wire;
  - .7 brace wire;

- .8 hinged gate(s) with padlocking provisions; gate to be of width to accommodate width of largest equipment in secured area, but not less than 1.5m (5ft.) and minimum height of 2m (6'-6"); review exact dimensions with Consultant prior to ordering.

### 1.36 DUST AND WATER CONTROLS

- .1 Provide protective measures necessary to ensure that existing building and adjacent areas to work of this contract will remain free from entry of dust or water at all times. Existing areas and rooms to be in use during construction period. Conduct work to minimize interferences. Coordinate with Owner to allow Owner's continual normal operations to be conducted. Exercise extreme care and caution to protect existing equipment and other components from contamination by dust and debris.
- .2 Include for following work:
  - .1 Provide required temporary enclosures and protective measures to protect existing equipment for entire duration of work in existing areas. Erect and maintain interior enclosures to isolate renovation from other areas and existing equipment.
  - .2 Prior to commencement of Work, protect existing equipment within work area with drop cloths, air barriers, protective panels, and enclosures. Such measures to prevent any debris from falling onto existing equipment, and to prevent dust migration from occurring. Support drop cloths from ceiling or other structure at a minimum 600mm (2ft.) above existing equipment, or other equipment as designated by Owner and coordinated with Consultant. Do not allow tools, drop cloths, materials, and construction aids to be placed on or against electrical or mechanical equipment unless such equipment has been properly and safely shutdown for performance of work and coordinated with Consultant.
  - .3 Thoroughly clean following items prior to bringing into existing areas and rooms:
    - .1 tools, equipment, and other construction aids;
    - .2 materials, parts, and other components to be installed;
    - .3 pipe, ducts and conduit: Remove dirt and scale for inside and outside surfaces;
    - .4 workers apparel.
- .3 To extent possible, perform cutting, drilling, welding, soldering, sanding, painting, finishing, and other construction operations outside existing areas in locations approved by Owner and reviewed by Consultant.
- .4 Work performed within existing areas:
  - .1 Continuously operate HEPA vacuum cleaner/ HEPA dust collectors to remove residue when cutting, filing, drilling or other similar work being performed within existing areas. Remove particles with HEPA vacuum cleaner during operation producing residues.
  - .2 Welding, soldering, and other fume producing operations being performed within existing areas: Provide supplemental power ventilation to building exterior. Do not commence fume-producing operations until ventilation apparatus is approved by Owner and reviewed by Consultant.
  - .3 At end of workday remove tools and materials from existing areas or place within room at location designated by Owner and coordinated with Consultant.
  - .4 Maintain work areas free of waste material, debris, and rubbish. Immediately remove debris and rubbish from areas of Work and associated pipe chases, plenums, access floor spaces, and above suspended ceiling.
- .5 Provide temporary dustproofing partitions as required prior to demolition. Treat openings, joints and cracks in enclosures to prevent any dust and moisture, from entering existing adjacent areas.
- .6 Remove existing walls with care. Avoid damage to Owner's equipment. Allow Consultant to review work before commencing with partition or wall removal. Minimize dust.

- .7 Where dustproof partitions are relocated for tying in of materials install partition from floor to ceiling and from ceiling to underside of slab without damaging finishes.
- .8 Render door leading into construction areas dust tight.
- .9 Damp mop surfaces in construction areas continually during demolition and daily during normal construction.
- .10 Seal ventilation ducts to or from construction area.
- .11 Employ a full time labourer to continuously clean up during demolition and during construction of dust proof partitions.
- .12 Temporary Partitions:
  - .1 Erect temporary dustproof partitions, consisting of 92 x 9.5mm (3-5/8" x 25 gauge) metal studs at 400mm (16") o.c., with top and bottom runners and intermediate horizontal supports at 1/3 points. Render partitions soundproof in areas of Work adjacent to existing operational spaces/areas, as directed by Owner and reviewed by Consultant. Confirm these areas on site prior to submitting Bid.
  - .2 Over one side of metal studs, install Griffolyn T55 or approved equal, fire retardant, reinforced clear laminated film, distributed by Morgan Scott Group Inc. 1700 Drew Road, Mississauga, Ontario L5S 1J6, Tel. No. 905-612-0909 or J-2 Products, 54 Audia Court, Unit 2, Concord, Ontario L4K 3N4, tel. no. 416-665-1404. Other local available products may be approved by Consultant, if equivalent. Secure film in place with double side adhesive tape capable of supporting film without delamination.
  - .3 Install felt gaskets around partition perimeter framing to prevent dust migration into adjoining areas.
  - .4 Provide new temporary doors and frames.
  - .5 Equip doors and butts, latchset or lockset, closer, weather stripping.
- .13 Be responsible for careful installation of dustproof partitions.
- .14 Allow Consultant to review erected partitions before proceeding with any construction and/or demolition work.
- .15 Do not remove dustproof partitions until areas have been reviewed with Consultant and acceptance given by Owner.
- .16 Carefully remove dustproof partitions and clean surfaces including walls, ceilings, floors, and top of equipment to Owner's acceptance and review with Consultant.
- .17 Be responsible for ventilation of fumes and odours that may occur during construction. Include for temporary partitions and temporary exhaust fans to ensure that fumes are properly extracted from work area.

### **1.37 WORKMANSHIP AND MATERIALS**

- .1 Materials used in execution of contract to be new and of best quality to perform work for which it is intended. No defective, unsound, or used material will be permitted.
- .2 Manufactured articles, material, and equipment to be applied, installed, connected, erected, cleaned, and conditioned in strict accordance with applicable manufacturer's instructions and directions.
- .3 Make no deviations from specifications or drawings without written request to Consultant and subsequent Consultant's review and response.
- .4 Where evidence exists that defective work has occurred, or that work has been carried out incorporating defective materials, or work has been damaged due to unprotected conditions, Consultant may have tests, inspections, surveys, analytical calculations of equipment performance

and the like to help determine whether work is to be corrected or replaced. These tests, inspections, surveys, analytical calculations of equipment performance and the like are to be made at Contractor's expense, regardless of the results.

- .5 Conduct testing in accordance with requirements of CSA, local governing codes, and local governing authorities, except where this would, in Consultant's opinion, cause undue delay or give results not representative of rejected material in place. In this case, tests are to be conducted in accordance with standards given by Consultant and/or Commissioning Authority.
- .6 Materials or work which fails to meet specified requirements, may be rejected by Consultant whenever found at any time prior to final acceptance of work regardless of previous inspections. If rejected, defective materials or work is to be promptly removed and replaced, or repaired to satisfaction of Owner, at no expense to Owner.

### **1.38 EQUIPMENT LOADS**

- .1 Supply equipment loads (dry weight, operating weight, housekeeping pad, inertia pads, and similar) to Consultant, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include any additional necessary accommodations.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with Consultant prior to construction.

### **1.39 OPENINGS**

- .1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings, where appropriate.
- .2 No openings will be permitted through completed structure without written request to Consultant and subsequent Consultant's review and response. Clearly and accurately show on a copy of drawings, any openings which are required through structure. Identify and submit to Consultant for review, well in advance of doing work, exact locations, elevations, and size of proposed openings.
- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.

### **1.40 CONSTRUCTION MACHINERY AND EQUIPMENT**

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval of Owner and review by Consultant.
- .2 Comply with codes, by-laws, and regulations governing erection and use of scaffolding and other equipment used for preparation, fabrication, conveying, and erection of Work.
- .3 Submit erection drawings if required by local authority having jurisdiction, Consultant, and Owner.
- .4 Submit to Consultant and Owner for review prior to start of work, erection and layout drawings and list of scaffolding, machinery, and equipment intended to be used in equipment rooms.
- .5 Erect scaffolding independent of walls and in a manner to avoid interference with parts of Work in progress. Obtain approval from Owner and allow Consultant to review.
- .6 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and review by Consultant.

- .7 Provide and maintain required shoring and bracing in accordance with Construction Safety Act and other applicable regulations.
- .8 Prevent sprayed materials from contaminating air beyond application area, by providing temporary enclosures.
- .9 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

**1.41 CHANGES IN THE WORK**

- .1 Unless otherwise stated in the Contract, or the Supplementary Conditions, whenever Consultant proposes in writing to make a Change or revision to design, arrangement, quantity, or type of any work from that required by the Documents, prepare and submit to Consultant for review, a quotation for executing the Change or revision. The Change or revision shall be determined by one or more of the following methods as determined by the Consultant:
  - .1 By estimate and acceptance of a lump sum (“Lump Sum Method”); or
  - .2 Where unit prices, discounts and allowances are set out in the Contract Documents or subsequently agreed upon, in accordance with such unit prices (“Unit Price Method”); or
  - .3 By actual time and material costs and a fixed or percentage fee for overhead and profit (“Time and Material Method”).
- .2 Changes in the Work evaluated using the Lump Sum Method or Time and Material Method shall be based on the following factors:
  - .1 For Materials and Equipment - The latest edition of Allpriser published list prices, less the following discounts:

	<b>Item</b>	<b>Discount</b>
1	Steel Pipe	50%
2	Copper Pipe	45%
3	Cast Iron Soil Pipe	45%
4	Stainless Steel Pipe and fittings:	45%
5	Welded Fittings:	50%
6	Grooved Fittings:	30%
7	Threaded Fittings:	40%
8	Cast Iron Screwed Fittings:	40%
9	Copper Fittings:	45%
10	Cast Iron MJ Fittings:	35%
11	Valves:	25%
12	Insulation Materials:	35%
13	All Other Materials:	25%
14	Equipment Rental:	Actual Rate, but not to exceed local rates.

- .2 For Base Labour Units:
  - .1 mechanical labour unit costs are to be in accordance with Mechanical Contractors Association of America (MCAA) Labor Estimating Manual;
  - .2 electrical labour unit costs are to be in accordance with National Electrical Contractors Association (NECA) Manual of Labor Units;
  - .3 other such standardized trade units that may exist, on a Journeyman basis.
- .3 Provide copies of the Allpriser published list prices used to estimate material and equipment costs, and copies of the NECA, MCAA, SMACNA or other such standardized trade rates used to determine labour units when requested by the Consultant.
- .4 It is understood that each change may have a variety of non-typical or abnormal factors that will require adjustments. Under no circumstances shall the cumulative total of additional factors exceed 20% of the hours established using Base Labour units.
- .5 Labour rates shall include all associated project management, estimating, supervision, scheduling, coordination, interference, as-built drawing production/updates, travel time and associated expenses, delivery charges, clean-up, printing, telephone and other office expenses, and applicable employee benefits and burdens including, but not limited to:
  - .1 Base Rate
  - .2 Vacation/Stat Pay
  - .3 Union Deductions
  - .4 Legislated Burdens
    - .1 Employer Health Tax (EHT)
    - .2 Workplace Safety and Insurance Board (WSIB)
    - .3 Employment Insurance (EI)
    - .4 Canadian Pension Plan (CPP)
    - .5 Retail Sales Tax (RST) on Hardware.
  - .5 Expendable Small Tools
  - .6 Additional Unionized Charges
  - .7 Finance Payroll
  - .8 Rest Breaks
  - .9 Idle Time
  - .10 Safety
    - .1 Job Box Talks
    - .2 WHMIS
    - .3 Fall Protection
    - .4 Personal Protective Equipment
    - .5 Committees
  - .11 Labour Warranties
- .3 The following additional requirements apply to all Change quotations submitted:
  - .1 costs for Journeyman and Apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing the work;

- .2 Change pricing must be such that Site Superintendent's involvement is necessary; cost for Site Superintendent must not exceed 10% of total hours of labour estimated for Change or revision;
- .3 Change quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .4 The Contractor shall at the request of the Owner, and/or the Project Manager, and/or the Consultant provide all required supplementary documentation requested by the Owner, and/or the Project Manager, and/or the Consultant for any Change.
- .5 Where Changes are evaluated using either the Lump Sum Method, or the Time and Material Method, the cost to the Owner shall be the actual cost of credits and, where additional work is required; the cost to the Owner shall be the actual cost plus a percentage covering overhead and profit, after all credits included in the Change have been deducted.
- .6 Where Changes are evaluated using either the Lump Sum Method, or the Time and Material Method, credit pricing for deleted work not already performed shall have a credit value assessed that is not less than 80% of the value of charges for similar new work.
- .7 Where Changes are evaluated using either the Lump Sum Method, or the Time and Material Method, the mark-up for overhead and profit shall be limited to and be calculated as follows;
  - .1 Work carried out by the Trade Contractor or Trade Subcontractor: 10% overhead and profit combined.
  - .2 Trade Contractor's overhead and profit on Trade Subcontractor's work: 5% overhead and profit combined.
- .8 The cumulative total percentage for overhead and profit charged by the Trade Contractor, Trade Subcontractor and others shall not exceed 20% of the cumulative total value of such change in the work, net of overhead and profit.
- .9 Trade Contractor and trade Subcontractor's overhead and profit shall be calculated on net additional work only.
- .10 For Changes involving net deletions only, overhead and profit shall not be deducted, but shall include taxes and duties.
- .11 Where Changes are evaluated using the Unit Price method, the value of the change shall be based on the net difference in quantities with the appropriate Unit Rate applied.
- .12 Where changes are extensive, or where requested by the Owner, and/or Project Manager, and/or Consultant, material and labour take-offs shall be organized on a drawing-by-drawing, or area-by-area basis by the Contractor to more readily facilitate verification of quantities and labour hours.
- .13 Change quotation summaries shall itemize HST separately.
- .14 Change quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal.
- .15 Failure to submit a proper quotation to enable the Owner, and/or Project Manager, and/or Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .16 Submit proposed Change quotations in writing for review by Consultant; if Consultant agrees a Change Order will be issued.
- .17 Do not execute any Change or revision until written authorization for Change or revision has been issued by the Consultant.

#### **1.42 FIELD REVIEWS**

- .1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work,



- for commissioning demonstrations, and any other such required field review, provide a minimum five (5) working days notice in writing to Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time coordinated with Consultant.
  - .3 Do not conceal work until Consultant advises that it may be concealed.
  - .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.
  - .5 The Consultant's general review during construction are undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.
  - .6 The Contractor shall provide access to the Consultant to facilitate review of the Work at no extra cost to the Owner or the Consultant. Where work is carried out by swing stage, provide a third life-line.
  - .7 Should additional work and/or visits by the Consultant be required because of the Contractor's failure to perform in accordance with the Contract Documents, or if additional design or drafting time is required by the Consultant to provide/review corrective measures caused by the Contractor's failure to perform in accordance with the Contract Documents, the Contractor shall reimburse the Consultant at the rate of direct personnel expense plus 150% overhead plus travel, equipment and material costs plus H.S.T. where applicable. This cost cannot be passed onto the Owner.

#### **1.43 PRELIMINARY TESTING**

- .1 When directed by Consultant, include for performance of site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, and similar devices are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

#### **1.44 PROJECT SIGNS**

- .1 No signs or advertisements of any description, other than those regarding safety, caution, and instructions shall be permitted.

#### **1.45 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION**

- .1 Permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.
- .2 Permanent mechanical systems in building may be used for temporary heating or cooling during construction subject to following conditions:
  - .1 each entire system is complete, pressure tested, cleaned, and flushed out;
  - .2 specified water treatment system has been commissioned, and treatment is being continuously monitored;

- .3 building has been closed-in and areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes;
  - .4 there is no possibility of damage from any cause;
  - .5 supply ventilation systems are protected by 60% filters, which are to be inspected daily, and changed every 2 weeks, or more frequently as required;
  - .6 return air systems have approved construction filters over openings, inlets, and outlets;
  - .7 systems are operated in accordance with manufacturer's recommendations or instructions, and are monitored on a regular and frequent basis;
  - .8 warranties are not affected in any way;
  - .9 regular preventive and other manufacturer's recommended maintenance routines are performed;
  - .10 before application for Certificate of Substantial Performance of the Work, each entire system is to be refurbished, cleaned internally and externally, restored to "as-new" condition, and filters in air systems replaced;
  - .11 energy costs are to be paid by Contractor.
- .3 Confirm with Consultant what equipment can be used during construction.
  - .4 Any system or piece of equipment that is specified to be provided under requirements of Project Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.
  - .5 During this period of construction, such systems/equipment to not become property of Owner or be Owner's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Owner.
  - .6 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, ensure new and modified systems/equipment affected by the Work are cleaned, restored to "new" condition.

#### **1.46 CUTTING, CHASING AND CORE DRILLING**

- .1 Cutting, chasing, and minor demolition required for Work to be responsibility of Prime Contractor, who is to either perform these operations with Contractor's own forces under this Section of Work, or in some cases as later set out, engage particular sub-trade responsible for material affected. Submit core-drilling requests in a shop drawing form, indicating location with respect to gridlines, size of openings and elevation with dimensions to soffit of beams or edges of openings for Consultant's review, prior to start of Work.
- .2 Criteria for Cutting Holes for new services:
  - .1 cut holes through slabs only; no holes to be cut through beams;
  - .2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;
  - .3 keep at least 100 mm (4") clear from beam faces;
  - .4 space at least 3 hole diameters on center;
  - .5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;

- .6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;
- .7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.
- .3 Perform required core drilling. Cut, chase, and make good to leave Work in a finished condition where new Work connects with existing and where existing Work is altered.
- .4 Where a trade section corresponding to any part of existing Work is not included in Specifications, cutting and chasing for such portions of Work under this category to be provided under this Section.
- .5 Where new Work penetrates existing construction, core drill or saw cut an opening. Size openings to leave 13 mm (1/2") clearance around Work and pack and seal the void between opening and Work for length of opening with ULC listed and labelled material to achieve a ULC listed fire stop and smoke seal assembly.
- .6 Prior to drilling or cutting an opening, in consultation with Consultant and Owner, determine by use of non-destructive radar scanning of the slab or wall, the presence, if any, of existing services and reinforcement bars concealed behind building surface to be cut; locate openings to suit. Contractor will be held responsible for damage to existing services caused by core drilling or cutting openings. In areas that scanning is not permitted by Owner or where scanning equipment cannot access, hand chisel to expose any reinforcing steel or buried services.
- .7 Do not cut any existing Work without coordination with and review by Consultant. Perform cutting, coring and scanning after normal working hours. Normal working hours are defined in **Working Hours** under **Project Schedule** within this Section, or confirmed with Consultant.

#### 1.47 PATCHING AND MAKING GOOD

- .1 Patching and making good to be responsibility of Prime Contractor and be performed by trade specialist in particular material to be treated, and to be made indistinguishable in finished work when viewed from distance of 1500 mm (5ft.) under normal lighting. Unless otherwise approved by Owner and reviewed with Consultant, patch openings and penetrations same day as cutting/drilling of work. Provide ULC listed fire stop and smoke seal assembly for penetrations in fire rated partitions, slabs, and ceilings.
- .2 Where existing openings are indicated as filled in, new openings cut into existing walls, existing items removed, or any form of alteration to existing surface or material is made, term "Make Good" is deemed to apply whether specifically noted or not.
- .3 Where term "Make Good" is implied or used on drawings or in Specifications to refer to repairing or filling operations performed on existing floors, walls, ceilings or any other exposed surfaces, it is intended that finished surfaces match and line with existing adjoining surfaces.
- .4 Paint patched areas to match existing. Unless otherwise noted, include for one coat of base primer enamel and minimum two coats of alkyd enamel finish. If paint colour cannot be found to match existing, repaint entire ceiling and/or partition wall. Apply sufficient number of coats such that patched area is indistinguishable from surrounding area.
- .5 Continue base, dados, and miscellaneous moulds and features around face of patched areas.
- .6 Where existing surfaces are damaged by Work and/or where existing devices are removed from wall, ceilings, floors and other surfaces, and such deleted devices are not being replaced in same locations, patch locations of these removed devices and re-finish. Patching and finishing is to be provided by tradesmen skilled in particular trade or application worked on by trade. Where openings are left in existing ceiling tiles, replace ceiling tiles with new matching tiles coordinated with and reviewed by Consultant. Unless otherwise included for in other Divisions, include for:
  - .1 preparing existing surfaces to be filled and repainted to be cleaned as required to remove dirt, dust, oil, grease, loose paint, rust and any other foreign matter which would prevent proper bonding of new finish; sand glossy surfaces to uniform dull texture;

- .2 filling in and patching surfaces with same material as existing surfaces; finished surfaces to match and line with existing adjoining surfaces;
- .3 provide ULC listed fire stop and smoke seal assembly to maintain fire rating of surfaces penetrated;
- .4 using paint rollers and/or brushes to apply and extend paint finish over full height and/or width of area affected, to a straight line in location coordinated with and reviewed by Consultant;
- .5 applying sufficient number of coats such that patched area is indistinguishable to surrounding area;
- .6 materials used to be of equivalent quality to existing finishes standards and be compatible with finishes to which they are applied;
- .7 finishes to be coordinated and reviewed with Consultant.

**1.48 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE**

- .1 Maintain equipment in accordance with manufacturer's instructions prior to start-up, testing and commissioning. Any completed work damaged prior to completion of the Work shall be rectified at the Contractor's expense. Report immediately, in writing to the Owner, all incidents of damage to the installations by vandals or others prior to acceptance.
- .2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.
- .3 Where equipment lubrication fittings are not easily accessible, extend fittings to accessible locations using copper or aluminium tubing.
- .4 All filters are to be new upon certification of Substantial Performance of the Work. This is in addition to any spare filters specified.

**1.49 RESTORATION**

- .1 Repair all areas having been damaged in the process of execution of the Work and replace all items being damaged beyond repair, to the complete satisfaction of the Owner.
- .2 Repair all areas having been damaged on adjacent properties in the process of execution of the Work and replace all items damaged beyond repair, to the complete satisfaction of the Owner and the adjacent property Owner. In all cases, blend with existing conditions.

**1.50 WARRANTY**

- .1 General: The Contractor shall submit a full labour and material warranty against defective workmanship or materials that result in maintenance or repair for a period of TWO (2) years from the date of Substantial performance of the Contract.
- .2 Water Seal Installation: The Contractor shall submit a full labour and material warranty against defective workmanship or materials that result in water penetration, material incompatibility, material failure etc for a period of FIVE (5) years from the date of Substantial Performance of the Contract.
- .3 Contractor shall provide a warranty by the sealant manufacturer covering a period of TWO (2) years for all labour and materials from the date of Substantial Performance of the contract agreeing to furnish sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within the specified warranty period.

- .4 Mechanical and Electrical: Mechanical and Electrical warranty requirements are defined within the specific Mechanical General Requirements and Electrical General Requirements sections within these specifications.
- .5 Warranty coverage to include the repair of any premise/content property damaged as a result of failure of the roof waterproofing assembly system.
- .6 The warranty is to be supplied on official company letterhead and shall bear the corporate seal.
- .7 Within 10 days of written notification from the Owner, the Contractor is to begin taking step to rectify the above defects including all cost associated with replacement and reinstatement of the expansion joint assembly, including the cost of making good items damaged or removed in order to perform the work.

#### **1.51 PROJECT CLOSE-OUT DOCUMENTS**

- .1 Project close-out documents are to include, at a minimum:
  - .2 Letters of Completion
    - .1 Letter from General Contractor (dated & signed)
    - .2 Compliance letter from the Consultants (dated & signed)
    - .3 Substantial Completion Certificate (signed Form 9)
  - .3 Contact Info
    - .1 Project contact from all parties (Names/Mobile#)
    - .2 Warranty contact (Company name/Contact / Phone #)
  - .4 Warranty Certificate
    - .1 General warranty (workmanship/Part & Labour)
    - .2 Specific equipment warranty (extended warranty from manufacturers)
  - .5 Testing & Balancing Reports
    - .1 All test & balancing reports
    - .2 Consultant's final field inspection report (confirmation of no deficiencies)
  - .6 Commissioning Reports
    - .1 Complete Commissioning procedure/Checklist
  - .7 Inspection Certificates
    - .1 Various certificates from Authorities having jurisdiction (ESA, TSSA ..)
  - .8 Operating & Maintenance Manual
    - .1 All major equipment
    - .2 Training manuals
  - .9 Reviewed Shop Drawings
    - .1 Reviewed shop drawings having the consultant's stamp.
  - .10 Complete As-Built Drawings (Incl. Cad Files)

- .11 Construction Photos
- .12 Additionally, adhere to all requirements for close-out documents as indicated within any other sections within this specification.

**1.52 CLEANING**

- .1 Keep site free from accumulations of surplus materials or rubbish caused by Trades or Subcontractors. Provide covered bins for removing debris and rubbish. At completion of work of each day, remove rubbish, tools, scaffolding, and surplus materials due to this Contract from and about premises, and leave whole of work in a clean and tidy condition to satisfaction of Owner and reviewed with Consultant. Owner may remove rubbish and charge such cost to Contractor as Owner determines to be just.
- .2 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to satisfaction of Owner and reviewed with Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.
- .3 At time of final cleaning, clean luminaire reflectors, lenses, and other luminary surfaces that have been exposed to construction dust and dirt, including top surface, whether it is exposed or in ceiling space. Clean all elements of the building adjacent to and affected by the Work, including but not limited to: glass, roof, and walls.
- .4 Remove debris from building in closed containers. Material not for reuse to become property of Contractor. Remove debris promptly from site. Make good all damage.
- .5 Where applicable to scope of Work:
  - .1 clean and make good surfaces soiled or otherwise damaged in connection with Work. Pay cost of replacing finishes or materials that cannot be satisfactorily cleaned;
  - .2 clean equipment and devices installed as part of this project;
  - .3 clean switches, receptacles, communications outlets, cover plates, and exposed surfaces.
- .6 For work performed in mechanical and electrical equipment rooms, electrical closets and communication closets, perform following:
  - .1 HEPA vacuum and clean interiors and buswork of switchboards, panels, cabinets and other electrical equipment of construction debris and dust prior to energization;
  - .2 HEPA vacuum top of switchboards, panels, cabinets, bus ducts, cable trays and conduits in room, followed by a thorough HEPA vacuuming of floors;
  - .3 do not lay permanent switchboard matting in electrical rooms until rooms are re-cleaned, and floors wet mopped and dried just prior to final turn over to Owner.

**PART 2 - PRODUCTS**

**2.01 NIL**

**PART 3 - EXECUTION**

**3.01 NIL**

**END OF SECTION 01 03 00**

## **DIVISION 01 – GENERAL REQUIREMENTS**

### Section 01 11 13 – Building Envelope Work Covered by Contract Documents

#### 1.1 GENERAL

- .1 Bids shall be based on the materials and methods as outlined in the bid documents. If the contractor cannot meet the requirements, no bid shall be entered.
- .2 Refer to the technical specifications and drawings sections for products, and technical requirements.

#### 1.2 SCOPE OF WORK

- .1 The work outlined herein is a general description. The specific requirements for the execution of the Work shall be as described in the bid documents. The itemized tasks of work outlined below correspond with the items outlined in Section 00 40 00 – Building Envelope Schedule of Work Items.

#### 1.3 PURPOSE OF WORK

- .1 The purpose of this project is to address issues related to air leakage throughout the building envelope and reports of and occupant comfort related issues.

#### 1.4 BASE BID

##### .1 Mobilization

- .1 Mobilize on site all plant, tools, equipment and labour required to carry out this Work.

##### .2 Bonds and Permits

- .1 Provide specified bonds to the Owner following the contract award. Work must not commence without the submission of the Performance Bond, and the Material and Labour Bond.
- .2 Obtain and pay for all Federal, Provincial and Municipal permits necessary for this work, with the exception of the building permit, which will be obtained by the Owner.

##### .3 General Requirements

- .1 Provide all the necessary labour, plant, equipment, and materials necessary to conform to all requirements as specified in the Contract Documents. This includes, but is not limited to temporary lighting, access (interior and exterior as required to facilitate work), shoring, etc. Install all necessary fencing, hoarding, barriers and signage to protect staff, building elements, vehicular and pedestrian traffic in accordance with the Occupational Health and Safety Act. Include all necessary construction signage and coordination. Signage is to be properly lettered and visible. In addition to preventing injury, all work areas must be protected from damage due to equipment. Provide temporary support to existing structural loads, where required, to ensure the building is maintained in a safe condition and damage is not caused to building elements. Any damage as a result of inadequate shoring or support shall be rectified at no additional cost to the Owner. Include the supply, installation, maintenance, removal and disposal of full height interior dust protection enclosures or coverings around the perimeter of the windows to be replaced such that no construction dust penetrates into the interior of the building. Include the manufacture and installation of all necessary material and performance of site mock-ups that will be required to the satisfaction of the Owner and Consultant. Make allowances during construction for down time made necessary for access to and review of the Work by Consultant.

- .2 Make allowance to accommodate carrying out noisy work outside of normal working operation hours. Note that the building will be in operation.
- .3 Make allowances as required to facilitate the Consultant's review of the work at all aspects of the Work.
- .4 Demobilization and Site Cleanup Including Façade Cleaning
  - .1 Demobilize all plant, tools, equipment and labour for this Work from site. Upon completion of Work, and immediately before the Consultant's final review for Total Performance of the work, all areas of the building affected by this Contract shall be thoroughly cleaned. Include the dismantling and removal of the scaffolding at the completion of the project. Remove all temporary protection, equipment, waste and surplus materials from site and leave in neat, tidy condition to the satisfaction of the Owner.
  - .2 Façade Cleaning: Clean and wash all areas of the façade affected by the work. This includes but is not limited to: the windows, metal flashing, brick masonry, and precast concrete elements throughout the façade of the work area. This includes light abrasive cleaning by mechanical means of the brick masonry and precast concrete elements throughout the full extent of the work area, to remove mortar staining and any other cementitious or adhesive foreign elements including atmospheric soiling. Cleaning is to be performed immediately after the repair work. This includes the performance of a mock-up, or mock-ups as required, for acceptance by the Consultant and Owner, prior to the start of cleaning. This also includes the cleaning of the windows and the façade immediately adjacent to the work area to the satisfaction of the Owner, if required, due to the Work within the work area.
- .5 Exploratory Work
  - .1 Complete interior and exterior exploratory openings as directed by the Consultant. Exploratory work must be done 3 weeks prior to construction start and before material ordering. Following exploratory work, the Consultant will confirm the suitability of details on R310, R311, and 3/R501. The Consultant will also advise on any additional scope to be added, through the cash allowance, to the Exterior Dog Run.
  - .2 Interior Openings: Create two 16" by 12" openings within the interior ceiling finishes of the south sloped roof area, one opening at the roof crest and one opening at the wall to ceiling junction. Remove interior finishes and concealed assembly up to the underside of the roof sheathing. Provide all necessary containment measures for interior openings, including but not limited to dust protection and HEPA filters. Following Consultant investigation, complete repairs to interior openings including replacement of all necessary envelope components and interior finishes.
  - .3 Exterior Openings Metal Clad Wall Type 2: Create two exterior openings near the center of the Metal Clad Wall Type 2. The first opening to be made above a south facing window with wall height of approximately 1,000 mm. the second opening to be made above an east facing window near the main entrance with wall height of approximately 600 mm. Remove metal wall and parapet cladding as necessary to facilitate opening. Cut 12" by 12" opening in wall sheathing avoiding damage to wood framing. Remove interior assembly components, i.e. insulation and vapour barrier, as necessary to facilitate review of the roof to wall structure transition details and the wall to glazing tie in details. Complete temporary repairs to the openings to provide a watertight seal prior to confirmation that the wall rebuild details are suitable.



- .4 Exterior Opening at Dog Run Roof to Wall Transition: Create opening in masonry wall, including removal of rigid insulation and exposure of backside of concrete masonry unit back up wall. Remove brick near the bottom of the wall where masonry repairs are anticipated, creating opening of 12" by 12". Remove interior assembly components, i.e. insulation and vapour barrier, as necessary to facilitate Consultant's review. Following Consultant review, complete masonry replacements.
- .6 Metal Cladding Wall Rebuild
  - .1 Rebuild Metal Clad Wall Types 1 and 2 and 3.
    - .1 Remove existing metal parapet flashing, metal wall cladding, and exterior sheathing. Existing wood framing and steel structure to remain undisturbed.
    - .2 Where accessible refasten existing poly vapour barrier to the existing structure at the top and bottom of the metal clad wall. Maintain existing wall cavity insulation.
    - .3 Supply and install new parapet exterior sheathing and continuous vapour permeable air barrier. Tie membrane into the glazing frames below the metal clad wall with a continuous 25mm bead of sealant. At the top of the wall lap the membrane beneath the parapet level membrane.
    - .4 Supply and install new parapet level vapour permeable air barrier membrane from the roof deck, up and over the parapets above the metal clad walls and lapped over the membrane on the new wall sheathing. Lay the membrane in a continuous 25mm bead of sealant at the leading edges at the roof deck and at the lapped joint between the parapet and wall membrane. Tool the membrane into the sealant and seal the leading edges.
    - .5 At Metal Clad Wall Type 1 and 3 supply and install new 75 mm exterior insulation board over wall area.
    - .6 Supply and install new metal wall cladding. At the bottom of the cladding install a new closure complete with weep holes. Install new drip edge flashing at the bottom of the metal clad wall.
    - .7 Supply and install new metal parapet cap flashing that is wide enough to fully cover the new air barrier system and extends over the top edge of the new metal cladding. any added wall insulation.
  - .2 Provide and install a mock-up for each metal clad wall type, as per Specifications, to be reviewed and accepted by Consultant, prior to the start of metal cladding wall rebuild modifications.
- .7 Roof to Wall Transition Repairs
  - .1 Rebuild Parapet Types 1, 2, 3 & 4
    - .1 Remove existing metal parapet flashing at all flat roof areas. Remove portion of existing modified bitumen roofing membrane extending over parapet blocking. Complete repairs to the parapet blocking as necessary. Coincide parapet work with masonry repointing and repairs.

- .2 Remove and dispose of abandoned metal posts fastened to the masonry wall within the parapet type 4 area. Complete masonry repairs following post removal and prior to new parapet membrane and flashing installations.
  - .3 Remove existing flush mount vent in masonry wall within parapet type 4 area. Supply and install new extended vent with cover to accommodate added membrane and flashing installations.
  - .4 Supply and install new vapour permeable air barrier membrane from the roof deck, up and over the parapets, and extending down onto the face of the masonry to at least the second course of brick beneath the parapet blocking. Lay the membrane in a continuous 25mm bead of sealant at the leading edges both at the roof deck and at the outer side of the parapet at the second course of brick below the parapets. Tool the membrane into the sealant and seal the leading edge.
  - .5 Supply and install new metal parapet cap flashing that is wide enough to fully cover the new air barrier system.
  - .6 Provide and install a mock-up of each parapet type, as per Specifications, to be reviewed and accepted by Consultant, prior to the start of parapet modifications.
- .8 Masonry Rehabilitation
- .1 Brick Masonry, Localized Replacement – Brick Types 1 and 2
    - .1 This includes all materials, labour and equipment to survey walls and mark all spalled, scaled and cracked brick masonry units within the work area. Provide sufficient notice for Consultant to review quantity (area) prior to proceeding with removals. Remove damaged brick masonry units and full depth of mortar joints at perimeter of replacement unit (or area), clean the surface of adjacent units and place new brick masonry units, bedding and pointing mortar. Include brick masonry unit and mortar joint removal and disposal and the supply and installation of the new brick masonry units, bedding and pointing mortar. Include all labour, materials and equipment to rake out the bedding mortar to the specified depth (1") and the supply and installation of pointing mortar as per Specifications. This includes the staging of the work, as required. This also includes the replacement of brick units behind the roof parapet metal flashing, where required. The total estimated number of localized brick masonry unit replacement throughout the Brick Type 1 work area is 2 square meters or 120 units and throughout the Brick Type 2 work area is 5 square meters or 300 units.
  - .2 Mortar Joint, Localized Repointing – Brick Types 1 and 2
    - .1 This includes all materials, labour and equipment to survey walls, other than the parapet wall areas noted for complete replacement, and mark all scaled, weathered and cracked mortar joints within the work area. Provide sufficient notice for Consultant to review quantity (area) prior to proceeding with removals. Cut out and rake deteriorated mortar, clean brick masonry surfaces, and install new pointing mortar and tool joint as per Specifications. This includes the staging of the work, as required. This also includes pointing of mortar joints behind the roof parapet metal flashing, where required. The total estimated quantity of pointing

throughout the Brick Type 1 work area is 1,000 linear meters and throughout the Brick Type 2 work area is 750 linear meters.

- .9 Seal Weephole
  - .1 At all existing weepholes in remove bug screens, install backer rod to depth of 3", and fill weepholes with mortar. Weep holes have been observed in both Brick Type 1 and Brick Type 2 areas.
- .10 Sealant Replacement
  - .1 Remove and replace sealant at all masonry control joints, masonry to metal cladding interfaces, glass to metal interfaces, and metal to metal interfaces, including all joints at the ground floor (perimeter of the building and cladding to foundation) and all other surfaces where sealant exists and is exposed to the weather.
  - .2 Install new needle bead sealant at all metal to metal connections of windows and metal to glazing joints.
    - .1 Install new needle bead sealant at the drip edge and seams of all parapet cap flashings.
- .11 Soffit Repairs
  - .1 Seal and Insulate the Flat Roof Soffit Above the Exterior Dog Run Exit Door
    - .1 Disassemble existing ventilated soffit. Install air barrier membrane at transition from masonry to roof deck around the perimeter of the soffit area. Install spray foam insulation over air barrier membrane. Supply and install new ventilated soffit.
  - .2 Seal and Insulate Transitions Between Flat Roof and Sloped Roofing:
    - .1 Exploratory work to be completed to confirm suitability of repair detail at these locations.
    - .2 Remove fascia panels at inner corner of sloped roofing transitions. Remove parapet flashing and first three panels of metal cladding above glazing on south elevations and near main entrance.
    - .3 At sloped roofing areas install wood blocking the depth of the rafter to act as backing for spray foam to be installed at transitions to the flat roof areas. Supply and install spray foam at transitions between sloped roofing and flat roofing.
    - .4 At flat roofing adjacent to sloped roofing, install sheet metal backing for spray foam. Supply and install spray foam at transitions to sloped roofing. Complete work in conjunction with metal clad wall rebuilding scope.
- .12 Window Jamb Repairs
  - .1 Remove existing metal panels installed at transition between floor to ceiling glazing and adjacent masonry walls. Locations include glazing on the south elevation and west elevation near the main entrance.
  - .2 Remove and dispose of backer rods within window to masonry transition cavity. Review interior metal panel confirming the panel is secure and all gaps are sealed prior to spray foam installation.

- .3 Supply and install spray foam within the cavity between the masonry and glazing from the exterior of the building. Monitor the interior panel for movement and ensure no spray foam leaks past the interior panel.
- .4 Trim and clean up the insulation and install new 3mm prefinished aluminum panels, colour to match existing. Full sheet metal to be used, no joints in the new aluminum panels. Panels to be countersunk and face fastened, with fasteners concealed by sealant. Install new sealant at all interior and exterior joints.

.13 Whole Building Air-tightness Testing Allowance

- .1 Retain qualified building science testing services to perform a Whole Building Air-tightness Test in accordance with ASTM E3158-18 Standard Test Method for Measuring the Air Leakage Rate of Large or Multizone Buildings. The purpose of this test is to quantify the air leakage rate of the building and identify sources of air infiltration. As per Toronto Green Standard v3 – Tier 2-4 Guidance Document Airtightness Testing Protocol & Process testing is to be an Operational test under depressurization.
- .2 The building science testing service shall performing building envelope diagnostics using infrared scanning in general compliance with ASTM E1186 “Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems” during the WBAT test..
- .3 Building science consultant is to issue (three) copies of a report showing the data from the WBAT.
- .4 The Contractor shall be responsible for scheduling test and ensuring the building is ready for testing. This will include, but not limited to, ensuring all air barrier repairs and improvements are complete and the mechanical systems are in the appropriate configuration.

.14 Testing Allowance

- .1 Arrange and pay for a third party testing company/consultant, acceptable to the Owner and Consultant, to perform testing specified herein and as directed by the Consultant. Examples of testing that may be requested include: sealant adhesion testing and mortar consistency helical tie pull out strength. Administer this allowance and do not arrange for testing beyond the stipulated amount without approval. No payment shall be made for costs incurred as a result of re-testing necessitated by work that has failed a previous test. Payment of this item is based on the cost to the Contractor marked up 10%. Unexpended portions of the testing allowance will be deducted from the Contract Price. Increase in allowance beyond the stipulated amount shall be authorized by a Change Order.

.15 Mechanical and Electrical Allowance for Envelope Work

- .1 This includes a contingency for mechanical and electrical system repairs not specified in the Contract Documents that are made necessary by the Work, due to conditions that were not visible upon, or reasonably inferable from an examination of the site as determined by the Consultant. Payment of this item is based on the cost to the Contractor marked up 10%. Unexpended portions of this allowance will be deducted from the Contract Price. Increase in allowance beyond the stipulated amount shall be authorized by a Change Order.

.16 Contingency Allowance

- .1 The Contingency Allowance may be used only with written approval from the Consultant and Owner.

END OF SECTION 01 11 13

## **DIVISION 3 – CONCRETE WORK**

### Section 03 41 00 – Cast-in-Place Concrete

#### **1.0 GENERAL**

##### **1.1 SCOPE OF WORK**

- .1 Provide all materials, labour, plant and equipment necessary to:
  - .1 Remove and dispose of existing concrete pad topping to facilitate glycol heating system replacement, and supply and install new reinforced cast-in-place concrete pad topping in accordance with Project Details. For pricing, assume existing concrete is reinforced and solid.

##### **1.2 REFERENCES**

- .1 The work will confirm with the most current version of the Ontario Building Code (OBC), amended by O. Reg 423/12 Minister's Ruling MR-06-S-07, any applicable acts of any authority having jurisdiction and the following:
- .2 CAN/CSA S448- Repair of Reinforced Concrete in Buildings and Parking Structures
- .3 CAN/CSA A23.1-14 - Concrete Materials and Methods of Concrete Construction
- .4 CAN/CSA A23.2-14 - Methods of Test for Concrete
- .5 CAN/CSA A23.3-14 - Design of Concrete Structures for Buildings
- .6 CAN/CSA A3000-13 – Cementitious Materials Compendium
- .7 CAN/CSA S413-14 - Parking Structures
- .8 CAN/CSA-O325-07 (R2012) - Construction Sheathing
- .9 CSA S269.1-1975 (R2003) - Falsework for Construction Purposes
- .10 CSA S269.3-M92 (R2013) - Concrete Formwork
- .11 CAN/CSA A283-06 (R2011) - Qualification Code for Concrete Testing Laboratories
- .12 ACI 117-10 - Standard Specifications for Tolerances for Concrete Construction and Materials
- .13 ASTM C260/C260M-10a - Specification for Air Entraining Admixtures for Concrete
- .14 ASTM C494/C494M-13- Specification for Chemical Admixtures for Concrete
- .15 Standards referenced by the Standards noted above are to apply even if they are not included in the list.
- .16 Where there are differences between the Specifications and Drawings and the codes, standards or acts, the most stringent shall govern.

##### **1.3 MOCK-UPS**

- .1 Three weeks prior to installation, the Contractor will provide a concrete colour and finish mock-up for the Owners signature and approval. Mock-up to be approximately 2 feet by 2 feet. Mock-up cannot form part of the work.

#### 1.4 SUBMITTALS

- .1 Concrete Mix Design: The contractor must submit the proposed mix design for all concrete mix types to the Consultant for approval two weeks prior to their initial use.
- .2 Curing Procedures: Submit a curing plan for the Consultant's review a minimum one week prior to concrete installation.
- .3 Control Joint Layout Drawing: Submit a layout drawing of each new cast-in-place concrete element with intended control joint layout, for Consultant's review (general control joint spacing requirements indicated in Section 3.5)
- .4 Certificate of Concrete Production Facilities: The contractor must submit the supplier's valid "Certificate of Concrete Production Facilities" as issued by the Ready Mixed Concrete Association of Ontario (RMCAO), including certification that all raw materials used in the production of concrete proposed for the work comply with the requirements of the specifications and CSA A23.1-14.
- .5 As-Built Drawings: The contractor must submit as-built plan and elevation drawings showing the size and location of all complete concrete repairs.

#### 1.5 GENERAL REQUIREMENTS

- .1 For the duration of the warranty periods, the concrete repairs performed under this contract shall not:
  - .1 Spall, scale or crack excessively.
  - .2 Debond from existing substrate.
  - .3 Delaminate due to reinforcing steel corrosion.

#### 2.0 PRODUCTS

2.1 All materials to be placed in accordance with the Contract specifications, and the manufacturer's requirements, whichever is more stringent.

#### 2.2 READY-MIX CONCRETE

- .1 New Slabs-on-Grade Concrete Toppings
  - .1 Exposure Class = C-1, for exposure to freezing, thawing and deicing salts
  - .2 28-Day Compressive Strength = 35 MPa
  - .3 Aggregate Size = 20mm
  - .4 Air Content = 5-8%
  - .5 Slump Before Super P = As indicated by Concrete Supplier
  - .6 Slump After Super P = Maximum 150 mm
  - .7 Chloride Ion Permeability = <1500 Coulombs within 91 days

#### 2.3 SEPARATION BOARD

- .1 Fibreboard expansion joint filler covered with fillet sealant bead

### 3.0 EXECUTION

#### 3.1 SHORING, FORMWORK AND FALSEWORK

- .1 Form all new cast-in-place concrete.
- .2 Shoring, formwork and falsework shall be designed by a Professional Engineer retained by the Contractor.

#### 3.2 CONSULTANT REVIEW

- .1 Obtain the Consultant's review of the reinforcing steel, layout, formwork, etc, before proceeding with subsequent work. Provide the Consultant a minimum 72 hours' notice for review.

#### 3.3 GENERAL

- .1 **Contractor cannot add water.**
- .2 Comply with the requirements of CSA A23.1. Place concrete in manner consistent with good construction practices for this type of work. Supply, mix, place, consolidate, finish, cure and protect concrete in strict accordance with CAN/CSA-A23.1-14. It is the responsibility of the Contractor to provide adequate methods of heating to control the placement and curing conditions. Do not have heating devices unattended.
- .3 Vibrate concrete with mechanical vibrators during placement.
- .4 Ensure the reinforcement is maintained in position to maintain the minimum concrete cover shown on drawings.
- .5 Ready Mix Concrete:
  - .1 Remove and dispose of the first cubic meter of concrete from each truck.
  - .2 Concrete placement to commence within 90 minutes of batch time.
  - .3 Concrete placement to stop within 120 minutes of batch time. Exceptions to this time frame will be permitted only with the Consultant's permission if previously approved chemical admixtures are used. The admixture must be shown on the Ready Mix Ticket.
- .6 Pre-Packaged Concrete Repair Materials:
  - .1 Mix and install repair material in accordance with manufacturer's instructions.
  - .2 Manufacturer's representative is to be present on site at the time of concrete placement.
- .7 New reinforcing steel bars shall be supported (with new chair reinforcement supports- masonry, wood, etc, supports are not acceptable) to maintain concrete cover. Reinforcing shall be tied and fixed into position, so as to prevent movement during concrete placement and consolidation. Place new reinforcing steel in accordance with CAN/CSA-A23.1-14.
- .8 Obtain the Consultant's review of reinforcing steel and position. Notify Consultant when reinforcement installation is complete and before placing concrete. At least 72 hours' notice shall be given to provide opportunity to review the Work.
- .9 Maintain accurate records of poured concrete items, to indicate date, location of pour, air temperature, field test results and test samples taken.



.10 At all times during the work, protect exposed concrete, exposed masonry and other exposed members from staining or becoming coated with concrete leakage due to continuing concreting operations. Members which become coated may be classed as defective by the Consultant.

.11 All concrete toppings to be placed on the same day for aesthetic uniformity.

### 3.4 MEANS AND METHODS OF PLACEMENT

.1 Equipment transporting concrete and runways used by equipment transporting concrete shall not be supported by the garage structural slab or other structural slabs. Or, if not other method an approved by Owner, Contractor is responsible for obtaining engineered checks associated with means and methods of construction. Contractor to provide Engineered letter to Consultant and Owner for their review before proceeding.

### 3.5 CONTROL AND EXPANSION JOINTS

.1 Provide expansion and control joints in new concrete toping and fill all expansion joints with bituminous fibreboard.

.2 Tool (not saw cut) all control joints and preform expansion joints.

.3 New Slabs-on-Grade: Joint size and layout in accordance with Project Details.

### 3.6 FINISHING

.1 The concrete finish is to be heavy broom finished in opposite direction to traffic finished.

.2 Finish all concrete surfaces to match adjacent elevations and slope away from walls and columns and towards drainage systems.

.3 Finish concrete in accordance with the requirements of CAN/CSA-A23.1-14. Commence troweling only after bleed water has disappeared and concrete has achieved initial set.

.4 Finish all edges with a 4" wide x ½" radius edging tool.

### 3.7 CURING

.1 Cure and protect concrete ready mix concrete in accordance with CAN/CSA-A23.1-14.

.2 Cure and protect pre-packaged concrete repair materials per manufacturer's recommendations.

.3 Completely restrict the new concrete vehicular traffic until a minimum period of seven days cure and the concrete has reached 100 percent (100%) of the specified 28 day compressive strength. Compressive strength cylinders to be site cured.

.4 The use of curing sealing compounds is not permitted.

.5 Wet curing must begin as soon as finishing is completed on any area.

.6 Wet cure ready-mixed concrete at 10°C for a minimum of seven (7) days. Start wet curing as soon as possible without damaging concrete surface. Self-consolidating concrete may require longer, confirm with supplier.

.7 Curing temperatures shall be maintained between 10°C and 30°C for the entire curing period. The contractor shall supply and install curing blankets, temporary heat and enclosures, including cost of installation, fuel, ventilation, operation, maintenance and removal of equipment at no cost to the contract when the curing temperature has or is expected to drop below 10°C during the curing period. The use of direct fired heaters discharging waste products into work areas will not be permitted.

### 3.8 TESTING

- .1 Concrete cylinders to be site-cured for a minimum 24 hours, or longer if otherwise noted in this specification or if requested by the Consultant.
- .2 **Reject and do not place concrete which does not meet the specified air and slump requirements shown on the approved concrete mix design.**
- .3 Test all concrete using a testing firm certified in accordance with CSA A283, retained by the Contractor, paid through the Contract cash allowances and approved by the Consultant.
- .4 Testing firm is to conduct all tests in accordance with CSA A23.2-14.
- .5 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials. Provide free access to all portions of the work, and cooperate with the testing firm.
- .6 Advise testing firm a minimum 24 hours in advance of concrete placement.
- .7 Samples of the concrete are to be taken the end of the chute of the concrete supply truck.
- .8 Testing firm to take a minimum of three test cylinders for a strength test and not less than one strength test for each 20m<sup>3</sup> of concrete, or portion thereof, for each type of concrete placed and not less than one test for each type of concrete placed in any one day.
- .9 Testing firm is to report results of tests immediately to the Contractor. The Contractor is responsible for ensuring that the concrete meets the requirements of the specifications. Report adverse test results to the Consultant immediately.
- .10 Testing firm is to submit to the Consultant Contractor and concrete supplier certified copies of test results within five days of test.
- .11 For all Portland cement concrete compressive strength tests, 100mm by 200mm or 150mm by 300mm cylinders shall be used.
- .12 In accordance with requirements of A23.1-14, provide storage facilities for site storage of all cylinders.

### 3.9 REPAIR OF SURFACE DEFECTS

- .1 Surface defects will be repaired at the Contractor's expense. Defects include, but aren't limited to: bugholes, honeycombing, fins, burs, etc.
- .2 Repair of surface defects shall begin immediately after form removal. For repair with epoxy mortar, concrete shall be dry.
- .3 Repair of surface defects shall be tightly bonded and shall result in concrete surfaces of uniform colour, texture and matching adjacent surfaces, free of shrinkage racks.

### 3.10 COLD WEATHER CONCRETING

- .1 When the ambient temperature is at or below 5°C, or when there is a probability of the ambient temperature falling below 5°C within 24 hour of concrete placement, provide all equipment necessary, have in-place and employ the following measures to protect the concrete before concrete placement starts:
- .2 Provide temporary equipment for heating concrete materials and forms. Protect, insulate and maintain the proper temperature and humidity of the concrete during curing in accordance with CSA A23.1.

- .3 When fresh concrete is to be cast against existing concrete, prevent the loss of heat by extending the protection for the fresh concrete at least 600mm over the existing.
- .4 Insulate, or enclose within the protective housing, tie rods, reinforcement or metal which projects from the concrete being protected.
- .5 Maintain housing, enclosures and supplementary heat in place for entire period of protection, except that sections may be temporarily removed as required to permit placing additional forms or concrete provided the uncovered concrete is not permitted to freeze.
- .6 Locate heating units to avoid heating concrete locally or drying it excessively. Avoid high temperature and dry heating within enclosures.
- .7 Take particular care to maintain edges and corners of concrete at the required temperature because of their greater vulnerability to freezing.
- .8 Provide sufficient insulation, and heat as necessary, to prevent freezing of soil which is against structural elements.
- .9 The application of deicing salts on completed work is not permitted.

END OF SECTION 03 41 00

## **DIVISION 4 – MASONRY**

### Section 04 90 00 – Masonry

#### 1.0 GENERAL

##### 1.1 SECTION INCLUDES

- .1 Clay Face Brick Masonry
- .2 Brick Masonry Mortar
- .3 Concrete Block Masonry
- .4 Concrete Block Mortar
- .5 Stabilization Anchors
- .6 Reinforcing and Connectors
- .7 Accessories

##### 1.2 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Building Envelope Work Covered by the Contract Documents.
- .2 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, permits, authorization from utilities, protection of adjacent roof areas, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.
- .3 Work of this section includes all necessary equipment and accessories to perform masonry repairs, mortar joint repointing, and painting in the following areas:
  - .1 Brick type 1 – red coloured brick associated with the original building footprint located on the northwest side of the animal shelter.
  - .2 Brick type 2 – tan coloured brick associated with the additions constructed along the east, south, and part of the west sides of the animal shelter.
- .4 This section shall include all accessories necessary to complete the work, tie-ins to adjacent systems, and modifications to existing flashings and finishes to accommodate the masonry repairs.
- .5 Where conflict exists in the scope of work, requirements, standards, or codes, the most stringent criteria shall apply.

##### 1.3 DEFINITIONS

- .1 As defined in CSA A371 “Masonry Construction for Buildings”:
  - .1 Repointing: Removing deteriorated mortar from the joints of a masonry wall and filling and finishing with new mortar.
  - .2 Tooling: Compressing and shaping the face of a masonry joint with a special tool to provide final contour.

##### 1.4 REFERENCES

- .1 CAN/CSA-A23.1: Concrete Materials and Methods of Concrete Construction

- .2 CAN/CSA-A23.2: Methods of Testing for Concrete
- .3 CAN/CSA-A23.3: Design of Concrete Structures
- .4 CAN/CSA-A82-14: Fired Masonry Brick Made From Clay or Shale
- .5 CSA A179: Mortar and Grout for Unit Masonry
- .6 CAN/CSA-A165 SERIES: CSA Standards on Concrete Masonry Units
- .7 CSA-S304.1: Design of Masonry Structures
- .8 CAN/CSA-A371: Masonry Construction for Buildings
- .9 CAN/CSA-A370: Connectors for Masonry

#### 1.5 SUBMITTALS

- .1 Two (2) weeks prior to the commencement of work, submit two (2) samples of the brick masonry units, concrete masonry units, and mortar to illustrate the finish colour and the texture, for approval by the Owner.
- .2 Submit the information directly to the Consultant.

#### 1.6 QUALITY ASSURANCE

- .1 Perform the work in accordance with the most recent version of CAN/CSA-A370 and CAN/CSA-A371.

#### 1.7 QUALIFICATIONS

- .1 The installer shall be a company specializing in masonry work with a minimum of ten (10) years proven experience for projects of similar size and complexity.
- .2 Use single masonry Contractor for all masonry work.

#### 1.8 MOCK-UP

- .1 Construct a typical mock-up two (2) weeks prior to commencing with the work at a location agreed with the Consultant to show the mortar colour, tooling, anchor and tie placement, installation and bond. The mock-up shall be at least 1000 mm by 1000 mm.
- .2 Upon receipt of written confirmation from the Consultant, the mock-up may remain as part of the finished work.
- .3 The Contractor must receive written confirmation of the mock-up acceptance prior to commencing with the work.
- .4 Approved mock-up shall serve as the standard to which all related work shall be evaluated.
- .5 Rejected mock-ups will be removed and disposed of at the expense of the Contractor.
- .6 The mock-up shall be completed using the specified mortar and supplied masonry. Upon completion and written confirmation of the mock-up and written confirmation from the Consultant, the mix proportions should be altered in order to provide the minimum bond and performance requirements.

#### 1.9 HELICAL TIE TESTING

- .1 Provide pull tests by an independent testing agency selected by the Consultant or by the helical tie manufacturer to demonstrate the ultimate pull out strength of the tie.

#### 1.10 DELIVERY, STORAGE AND PROTECTION

- .1 Provide weather protection and construction protection in accordance with CSA-S304.1.
- .2 Store cementitious materials and aggregates in accordance with CSA Standard A23.1
- .3 Store mortar in a cool dry place so as not to be in contact with earth and to be protected from elements.
- .4 Keep the materials dry and protected from the weather, freezing and contamination.
- .5 Ensure that the labels and seals on all materials are intact upon delivery.
- .6 Remove rejected or contaminated materials from the site.

#### 1.11 WARRANTY

- .1 The Contractor shall submit a warranty of the work of this section covering a period of not less than two (2) years from the date of Substantial Performance of the Contract. Substantial completion shall be determined by the Consultant and the Owner.
- .2 Defective work shall include, but is not limited to, cracking, crumbling, loss of adhesion, loss of cohesion, discolouration, premature deterioration and out of plane movement.

#### 1.12 ENVIRONMENTAL REQUIREMENTS

- .1 General:
  - .1 All work shall be performed in strict accordance with manufacturer's written requirements for all products specified in the specification.
  - .2 Should a conflict arise between the requirements of this section and the manufacturer's requirements, the more stringent requirements shall govern.
- .2 Masonry Construction:
  - .1 Execute the work when the ambient temperature is above four (4) degrees Celsius. When the ambient temperature is below four (4) degrees Celsius, use care and heat as directed by the Consultant. Refer to section 3.4.
  - .2 Brace the masonry walls as necessary to resist wind pressure and other lateral forces during construction.

#### 1.13 EXISTING CONDITIONS

- .1 The Contractor shall provide all required support to safely support all the loads.
- .2 The decision to replace and repoint the existing masonry is based on cracked mortar joints, loose and spalled faces. Should any other masonry deterioration be detected during the execution of the work that is unrelated to the noted visual defects, immediately inform the Consultant.
- .3 Report, in writing to the Consultant, any areas of deteriorated masonry revealed that are not a part of this work. Obtain the Consultant's approval and instruction for the repair and replacement of the masonry units before proceeding with the repair work.

- .4 Assist in the investigation of possible structural problems and report prior to commencing with the masonry work.
- .5 Study pointing styles and methods and reproducing them and submit a sample for approval before starting the work.
- .6 Examine horizontal and vertical joints to determine which were struck first and whether they are the same style, as well as the other aspects of workmanship, which establish the authenticity of the original work.

#### 1.14 ALTERNATIVES

- .1 Obtain the Consultant's approval before changing the manufacturer's brands or supply sources of mortar materials during the entire contract or other methods of mixing mortar specified elsewhere in this specification.

#### 2.0 PRODUCTS

##### 2.1 CLAY FACE BRICK MASONRY

- .1 New brick masonry to match the existing texture, size, colour and physical properties. New brick masonry to conform to CAN/CSA-A82-14.

##### 2.2 BRICK STAINING

- .1 Stain the face of the replacement brick to match the colour and sheen of the existing. Stain material to be mineral based, UV resistant, penetrating, mold, fungus, mildew and weather resistant.
- .2 Acceptable Manufacturers:
  - .1 PermaTint Limited
  - .2 Nawkaw Corporation

##### 2.3 BRICK PATCHING MORTAR

- .1 All core holes to be filled with Sika 123-**W**.
- .2 Existing brick finish to be replicated using a finish glaze. Acceptable stain/coating manufacturer: Refer to section 2.2.

##### 2.4 BRICK MASONRY MORTAR

- .1 Pre-bagged mortar mixed in strict accordance with the manufacturer's instructions.
- .2 Mortar Type N.
- .3 Acceptable products:
  - .1 Betomix Plus Type N as manufactured by Daubois Inc.
  - .2 King 1-1-6 Type N as manufactured by King Packaged Materials Company.
- .4 The colour of the mortar shall match the existing. Colouring pigments shall be used in accordance with the manufacturer's written recommendations.

- .1 Acceptable product: Inorganic mineral oxide colouring pigments as supplied by Elementis Pigments Inc. Toronto, ON. A sample of the mortar shall be provided to the Consultant prior to commencement of the work.
  - .2 Liquid pigments are not acceptable.
  - .5 Admixtures shall not be added to the mortar.
  - .6 Use same brand of materials for the entire project.
- 2.5 CONCRETE BLOCK MASONRY
- .1 New concrete block masonry, compressive strength = 15.0 MPa minimum on net area. New concrete block masonry to conform to CAN/CSA-A165 SERIES.
  - .2 All materials shall be neatly stored on pallets in a location designated by the Owner.
- 2.6 CONCRETE BLOCK MORTAR
- .1 Pre-bagged mortar mixed in strict accordance with the manufacturer's instructions.
  - .2 Acceptable products:
    - .1 King Block Mortar, as manufactured by King Packaged Materials Company.
    - .2 Bloc Mix, as manufactured by Daubois Inc.
  - .3 Type S for loadbearing walls unless noted.
  - .4 Conform to CAN/CSA-A179, 15 MPa minimum compressive strength at 28 days, 250mm (10") slump, maximum aggregate size 10mm (3/8").
- 2.7 REINFORCING AND CONNECTORS
- .1 All reinforcing and connectors shall be in conformance with CAN/CSA A370.
  - .2 Reinforcing connectors shall be installed in accordance with the manufacturer's instructions.
  - .3 All reinforcing and connectors shall have a corrosion protection level of III as specified in CAN/CSA A370.
  - .4 Ties shall be 8 mm Helifix 304 Stainless Steel Wall Ties manufactured by Helifix, or approved equal. Refer to drawings for tie length and spacing.
  - .5 Veneer Wall Anchors
    - .1 Rap Tie, heavy-duty holed rap-tie masonry connector with thermal heavy-duty L-Plate connector, by Fero.
    - .2 Adjustable Veneer Anchors/Ties as manufactured by Blok-lok.
- 2.8 ACCESSORIES
- .1 Thru-Wall Flashing for Walls: Modified bitumen membrane reinforced with non-woven polyester mat, self adhesive type membrane covered with plastic film on one side, self adhesive polyethylene protective film on the other. Minimum thickness 1.2 mm (47 mils)
    - .1 Acceptable Products: Blueskin TWF as manufactured by Bakor Inc., Sopraseal Stick 1600 as manufactured by Soprema or ExoAir TWF as manufactured by Tremco Inc.



- .2 All products to include seam sealer and primer as required in accordance with the manufacturer's written recommendations.
- .2 Metal Flashing: 24 gauge pre-finished aluminum, colour and profile to match the existing sheet metal flashing or as specified by the Owner.
- .3 Shelf Angle
  - .1 Angle to conform to CAN/CSA-G40.20/G40.21 grade 300W.
  - .2 Shop Primer: to CISC/CPMA Standard 2-75.
  - .3 Zinc-Rich Primer: Catha-Coat 302 as supplied by Devoe Coating Company (3 mils dry film thickness) or Carbozinc 11 as supplied by Carboline Company (2 to 3 mils dry film thickness) or approved alternative.
  - .4 Hot Dip Galvanizing: to CSA G164, minimum zinc coating of 600 g/m<sup>2</sup>.
- .4 Adhesive Anchors (secure shelf angle)
  - .1 ½" diameter stainless steel threaded rod, nut and washer.
  - .2 Epoxy Adhesive: HIT HY 200 as manufactured by Hilti or Epcon A7 as manufactured by ITW.

### 3.0 EXECUTION

#### 3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.
- .2 Commencing with the installation means acceptance of the existing substrates by the Contractor.
- .3 The Contractor shall sound and identify all masonry wall areas covered under contract for deteriorated mortar and brick. The Contractor shall commence with the repairs upon receipt of approval by the Consultant in writing.

#### 3.2 PREPARATION

- .1 Protect adjacent finished materials from marking or damage due to the work.
- .2 Seal and protect all openings, doors, windows and adjacent areas to minimize the potential for damage and the spread of dust, water or other materials into the building or adjacent sidewalks and properties.
- .3 Brace all openings to remain plumb.
- .4 All projections should be covered with rigid protection, secured into the joints for the duration of the work.
- .5 Any part of the scaffolding/swingstage shall not directly bear against the masonry. The Contractor to provide any isolating materials required to prevent damage to the existing masonry.
- .6 Provide and install the safety devices and signs near the work area.
- .7 Install temporary shoring, bracing or other supports as necessary to support loading in the area of work.

- .8 The top surface of uncompleted masonry and openings in the building during the work shall be completely covered and protected with non-staining waterproofing covers when the construction is not in process.

### 3.3 GENERAL

- .1 Build masonry plumb, level, and true to line with vertical joints in alignment.
- .2 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- .3 Tolerances shall conform to CAN3-A371.

### 3.4 COLD WEATHER PROTECTION

- .1 When laying masonry in ambient temperature below 4 deg C (40 deg F), use heat and maintain temperature of masonry materials. Protect completed work from freezing to satisfaction of the Consultant. Heat and maintain temperature of masonry materials to at least 4 deg C (40 deg F), but not more than 48 deg C (120 deg F), and maintain air temperature above 4 deg C (40 deg F) on both sides of masonry for period of at least 72 hours.
- .2 Do not use scorched sand. Do not use salts or anti-freezes. Use approved smokeless heaters.
- .3 Heat water to a minimum temperature of twenty (20) degrees Celsius and a maximum of thirty (30) degrees Celsius.
- .4 Use warm water and use less mix water in winter; cover sand to keep dry; heat sand and ensure no frozen lumps; use small batches; provide temporary heat and weather protection enclosure at area of masonry work; cover top of all unfinished work to prevent water or ice getting into masonry work.
- .5 When the temperature is ten (10) degrees Celsius or less, store cements and sands for immediate use within a heated enclosure. Allow these materials to reach a minimum temperature of ten (10) degrees Celsius or a temperature that is in equilibrium with the air in the enclosure.
- .6 At the time of the use, the temperature of the mortar is to be a minimum of fifteen (15) degrees Celsius and a maximum of thirty (30) degrees Celsius.

### 3.5 HOT WEATHER REQUIREMENTS

- .1 Do plan for hot weather construction. Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
- .2 Avoid using dry masonry in hot weather conditions. Use predampened brick nominally saturated, but surface dry at time of laying. Do not dip brick in a bucket of water.
- .3 Do spread only enough mortar to permit soft setting of masonry units; do not over mix mortar materials; do not retemper mortar after 2 hours of use; do not retemper pigment coloured mortar; do not spread more than 900 mm (3') of mortar for placement of brick.
- .4 Do not mix cement with water or with aggregate or with water-aggregate mixtures having a temperature higher than thirty (30) degrees Celsius.
- .5 When the air temperature is above thirty-eight (38) degrees Celsius or thirty-two (32) degrees Celsius with a wind velocity greater than 13 km/h, the spread of the mortar beds shall be less than 1.2 m and the masonry units shall be set within one (1) minute of spreading the mortar.

### 3.6 PROTECTION

- .1 Protect laid masonry from damage by weather. At end of each day or shutdown period, cover exposed tops of masonry with canvas or strong waterproof membrane securely clamped down and overhanging on each side of wall at least 600 mm (2'). Use wire spring clamps which extend 200 mm (8") down each side of wall, spaced 2400 mm (8') maximum or other approved method.
- .2 Provide temporary bracing to masonry work during erection to prevent damage due to winds or other lateral loads until permanent structure provides adequate bracing.
- .3 Contractor must maintain the exterior walls watertight at all times to prevent moisture penetration into the wall fabric. The Contractor shall be responsible for all costs associated with damage associated with moisture penetration resulting from inadequate protection as determined by the Consultant.

### 3.7 MORTAR REMOVAL

- .1 Mortar is defective when it is cracked, spalled, chalked or otherwise crumbling.
- .2 Consultant Review
  - .1 The Contractor shall provide access, permit inspection correct any defects and obtain written approval of all raked joints prior to commencing with the pointing.
- .3 Where mortar is found to be defective beyond the specified raking depth, the Contractor shall continue raking until solid mortar is encountered. Remove all loose mortar, dirt and other undesirable material.
- .4 Be aware that additional raking beyond specified depths will be necessary and that voiding can be expected. Back pointing will be required at these locations prior to repointing.
- .5 If masonry unseats or the bond is broken, remove the unit and reset in accordance with the work outlined in this section.
- .6 Tools and Techniques
  - .1 Tools used for cutting out of the mortar joints shall be narrower than the joint.
  - .2 Cutting out of the joint shall be performed using the following techniques:
    - .1 Hand held rotary saws or any type of grinder or wheel are permitted with the use of a HEPA vacuum bag system.
    - .2 The contractor shall coordinate mortar removal to ensure work producing dust does not affect the animals within the shelter or in exterior enclosures.
  - .3 *Only the centre line of the mortar joint maybe be removed utilizing a rotary saw or grinder. Hammers or chisels shall be utilized to remove mortar in direct contact with the brick surface.*
  - .4 The joints shall be cleaned back for the full 1". All mortar should be removed on the masonry surfaces to a square surface of existing mortar at the back of the joint.
  - .5 All loose particles in the mortar joints shall be removed with compressed air and left open for review by the Consultant.
- .7 Damage

- .1 The Contractor shall take all reasonable precautions in order to prevent damage to the masonry units resulting from the removal process.
  - .2 Such damage to the masonry includes but is not limited to the widening of the joints, nicks, gouges, and chipped or scratched surfaces from the cutting out tools due to improper workmanship.
  - .3 The Contractor shall replace or repair all damaged units to the satisfaction of the Consultant with no change in the contract price or schedule.
- .8 Depth of Raking
- .1 The depth of the raking shall be carried out to at least twice the width of the joint to a minimum depth of one inch (1") measured from the face of the masonry unit and beyond the existing depth of repointing.

### 3.8 BACK POINTING OF JOINTS

- .1 Obtain written acceptance from the Consultant of the raked out work prior to commencing with pointing operations.
- .2 Where the cut out joints are deeper than raking out depths specified, back point joints to bring the mortar face to the specified depth for raked out joints in preparation of finish pointing. Fill with mortar voids that cannot be filled with conventional back pointing.
- .3 Immediately prior to pointing, thoroughly wet the joints in order to control absorption.
- .4 Allow water to soak into masonry and mortar, leaving no standing water but remaining wet. Should the surfaces dry prior to pointing, the joints should be wet.
- .5 For back pointing, fill all joints full with pointing mortar. Compact the mortar firmly into the joints to ensure positive adhesion to all inner surfaces. Place mortar in layers, with a maximum thickness of one and one quarter (1-1/4) inches and a minimum of one half (1/2) inch. Each layer should be set to thumb print hard before placing the next layer. Bring the face of the mortar in back pointed joints to the specified depth for raked out joints, measured from the face of the masonry unit. Leave the joint ready for the final pointing.
- .6 Prevent the mortar from being placed or smeared onto the face of the masonry to minimize the potential for staining during back pointing.
- .7 Keep the work area clean; remove all droppings as the work proceeds, and again at the end of each day.

### 3.9 POINTING OF JOINTS

- .1 Obtain the Consultant's written acceptance of raked out and back pointed work prior to commencing with the pointing operation.
- .2 Prevent the mortar from being placed or smeared on to the face of the stone or masonry to minimize the potential for staining on the faces during the pointing.
- .3 Immediately prior to pointing, thoroughly wet the joints in order to control absorption.
- .4 Allow water to soak into masonry and mortar, leaving no standing water but remaining wet. Prior to pointing, the joints should be wet.

- .5 Fill all bed and head joints full with pointing mortar, compact joints firmly to ensure positive adhesion to all inner surfaces.
- .6 Thoroughly compact the mortar into the joints.
- .7 At initial set, finish neatly the joints to match the existing pointing style.
- .8 Keep the work area clean; remove all droppings as the work proceeds, and again at the end of each day.
- .9 Protection at Completion
  - .1 Protect newly laid mortar from frost, rainfall or rapid drying conditions for a minimum period of three (3) weeks.
  - .2 Cut out and replace all joints that dry prematurely and are lighter than the surrounding joints and have shrinkage cracks.

### 3.10 REPLACEMENT OF DETERIORATED BRICK

- .1 The Contractor shall mark the locations of masonry to be removed for verification by the Consultant prior to commencing with the removal process.
- .2 In any area, should the amount of deteriorated brick rise above 5% of the quantity approved by the Consultant, the Contractor must stop all work and notify the Consultant immediately. The Contractor must obtain written approval from the Consultant prior to replacing amounts of brick totaling above 5% of the approved quantity. If the Contractor proceeds above 5% without written approval from the Consultant, payment will not be received for all brick quantities above 5% of the approved quantity.
- .3 The brick is damaged or deteriorated when it is cracked, chipped, spalled or the outer face is hollow, detached or missing.
- .4 The Contractor shall maintain the stability of the structure/masonry wall at all times.
- .5 The Contractor shall cut out all damaged backup brick and prepare for the replacement of the new brick. Clean and remove all dust and brick fragments from the masonry. All loose material shall be removed from the adjacent substrates.
- .6 Localized Brick Replacement (less than 4 bricks per location)
  - .1 Bond, coursing and jointing to match the existing.
  - .2 Immediately prior to placing the masonry, thoroughly wet the adjacent substrates in order to control absorption.
  - .3 Allow water to soak into the masonry, leaving no standing water but remaining wet. Should the surfaces dry prior to pointing, the substrates should be wet again.
  - .4 Set the brick in a full bed of mortar, true to line, and level with the adjacent units.
  - .5 At walls with solid masonry type construction (Brick type 1) ensure the cavity to the rear of the brick is filled solidly with mortar.
  - .6 At walls with veneer type construction (Brick type 2) ensure that the cavity to the rear of the brick is kept free of mortar and debris to maintain the existing air space.
  - .7 Tool the mortar joints flush to match the existing.

.7 Rebuilding Areas of Brickwork

- .1 Where replacing in excess of four bricks in one area, install masonry ties to bond the facing with backup wythes of masonry.
- .2 The ties shall not be installed in advance of the masonry coursing.
- .3 The ties should be randomly installed in rebuilt areas, except where areas are sufficiently large for the tie to be set every twelve (12) inches horizontally and every twelve (12) inches vertically with staggered centres.
- .4 Drill entry hole into the block backup in accordance with the Manufacturer's recommended embedment length and hole diameter
- .5 Drive the tie into position.
- .6 Ensure that the ties are solidly set in the back-up wythe.
- .7 Bend the excess of the tie 90 deg with the Manufacturer's specified bending equipment prior to being wet set into the mortar joint.
- .8 General Procedures
  - .1 Slushing of the joints after the bricks are placed is not permitted.
  - .2 In the summer, if the initial rate of absorption of the brick is greater than 30 g/min:194 cm<sup>2</sup>, the bricks shall be thoroughly wetted for a period of three (3) to twenty-four (24) hours prior to use.
  - .3 Full head joints shall be obtained by double buttering of the ends of each brick being installed.
  - .4 At walls with solid masonry type construction (Brick type 1) Collar joints between the wythes shall be filled solidly with mortar].
  - .5 Mortar joint thickness and brick coursing shall match the existing. Variation in the brick size shall be evenly distributed in the wall so that the size is consistent.
  - .6 Feathered edges and mortar smears onto adjacent masonry surfaces are not acceptable.

3.11 SOLID MASONRY WALL STABILIZATION

.1 General

- .1 Refer to the drawings for the spacing of stabilization anchors.
- .2 Horizontal spacing of stabilization anchors to be a maximum of 1000 mm o/c.
- .3 Stabilization Anchors to be installed at each header course, 7 courses per floor. Refer to the drawings for anchor placement.
- .4 Helical ties to be installed at 500 mm o/c at locations of horizontal movement joints. Refer to the drawings.

.2 Installation of Helical Ties

- .1 Install ties at locations indicated on the drawings.

- .2 Drill entry hole into the block backup in accordance with the Manufacturer's recommended embedment length and hole diameter.
- .3 Drive the tie into position.
- .4 Ensure that the ties are solidly set in the back-up wythe.
- .5 Ensure that the tie is set 10 mm behind the face of the mortar/brick.

### 3.12 MOVEMENT JOINTS

#### .1 Horizontal (at shelf angle)

- .1 Provide horizontal movement joints in exterior masonry walls as indicated on Drawings.
- .2 Remove four courses of brick masonry above the shelf angle and two courses of brick masonry below the shelf angle.
- .3 Refasten existing shelf angle with adhesive anchors. Install new shelf angle with adhesive anchors. Refer to the drawings for sizes and spacing of anchors.
- .4 Install metal clip angles below the existing shelf angle to laterally restrain the concrete block backup wall as indicated on the drawings. The clip angle shall be welded to the existing shelf angle and shall be connected to the block wall with adhesive anchors. Provide a 1" long slot in the lower leg of the angle to allow for vertical movement of the block backup wall.
- .5 Adhesive Anchor Installation
  - .1 Angle and substrate to be drilled with a rotary drill to an appropriate depth or specify depth.
  - .2 Clean holes with a nylon brush and compressed air.
  - .3 Insert stainless steel screen tube into the hole. Ensure that the screen is not deformed during installation. Nylon screens are not acceptable.
  - .4 Inject epoxy adhesive into the hole/screen.
  - .5 Insert the anchor into the adhesive in a rotating manner to force the adhesive mortar into the hole.
  - .6 Remove any excess material and allow the anchor to set.
  - .7 Install the washer and nut and tighten to manufacturer's recommendations with a torque wrench.
- .6 Above the shelf angles, install reinforced modified bitumen thru-wall flashings through full thickness of exterior wythe up and over shelf angle and onto the floor slab/concrete block backup wall. Terminate membrane at the toe of the angle or terminate membrane by wrapping the membrane over the toe of the membrane and onto the underside of the shelf angle.

#### .2 Vertical

- .1 Provide vertical movement joints in exterior masonry walls as indicated on Drawings. Movement joints to be saw cut to a width of 13 mm ( $\frac{1}{2}$ ") and shall be the full depth of the

face brick. Joints should be free of debris and mortar and sealed with backer-rod and sealant.

- .2 Joint to be filled with a two-stage sealant joint.
- .3 Install helical ties on either side of the movement joint as indicated on the drawings.

### 3.13 METAL FLASHING INSTALLATION AT THE ROOF INTERFACE

- .1 Where required to complete the work, remove and retain existing sheet metal flashing at the parapet and masonry wall interface. The Contractor shall replace damaged material at no cost to the Owner.
- .2 Where required to complete the work, provide new membrane flashing tie-in with existing roofing material in a colour to match the existing condition.
- .3 Reinstall flashing to match the existing condition, extending onto the wall surface and providing a drip edge.
- .4 Where new flashing is required due to damage during the removal, provide S-lock joints and concealed fasteners.
- .5 Exposed fasteners will not be permitted, except in areas accepted by the Owner's Representative.

### 3.14 FIELD QUALITY CONTROL

- .1 All shop and field materials and workmanship shall be subject to review by the Owner or the Owner's Representative at all times. These reviews shall not relieve the Contractor from the obligations to provide materials conforming to all requirements of the contract documents.
- .2 Promptly remove any defective, damaged, or otherwise rejected material from the site. Installed materials which are damaged, or which in the opinion of the Owner do not conform to the contract documents, shall be removed and replaced with acceptable material at no additional cost to the Owner.

### 3.15 CLEANING

- .1 Clean masonry as work progresses using soft, clean cloths within few minutes after being placed. Upon completion, when mortar has set, so that it will not be damaged by cleaning, clean with soft sponge or brush and clean water. Polish with soft, clean cloths.
- .2 Clean masonry as work progresses. Allow mortar droppings on masonry to partially dry then remove by means of a trowel, followed by rubbing lightly with a masonry unit and brushing.
- .3 All holes in the mortar joints shall be filled with mortar and tooled.
- .4 Dry brush the masonry surfaces at the end of each days work and after the final pointing.
- .5 Remove mortar smears and droppings from the surfaces after they have dried.
- .6 Clean the finished brickwork. Remove all mortar stains on any exposed brickwork and clean the masonry with low pressure clean water and a soft bristle brush.
- .7 Remove all equipment and materials from the site upon completion of the work. Surfaces damaged during the course of the work shall be replaced by the Contractor at no cost to the Owner.



END OF SECTION 04 90 00

## **DIVISION 6 – WOOD, PLASTICS AND COMPOSITES**

### Section 06 10 00 – Rough Carpentry

#### 1. GENERAL

##### 1.1 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Work Covered by the Contract Documents.
- .2 Provide all labour, materials, products, equipment and services to complete the rough carpentry indicated on the Drawings and specified herein and/or necessary.

##### 1.2 REFERENCES

- .1 CAN3 O80-Series-97 Wood Preservation
- .2 CSA B111-1974 Wire Nails, Spikes and Staples
- .3 CSA O121-M1978 Douglas Fir Plywood
- .4 CAN/CSA-O141-91 Softwood Lumber
- .5 CSA O151-M1978 Canadian Softwood Plywood
- .6 CSA O153-M1980 Poplar Plywood

##### 1.3 QUALITY ASSURANCE

- .1 Identify all lumber and plywood delivered to the site by the grading stamp of an approved association or independent grading agency.
- .2 Carefully select individual pieces so that knots and obvious defects will not interfere with placing bolts, proper nailing or making proper connections.
- .3 Moisture content of wood at time of construction shall be 19% maximum and shall be processed and stamped at the mill.
- .4 Dimensions of lumber shall conform to dressed sizes specified in CAN/CSA-O141 unless actual dimensions are otherwise indicated or specified.
- .5 Dimensional references to lumber on drawings and in specifications are to nominal sizes unless actual dimensions are indicated. Such actual dimensions shall be dry size.
- .6 Discard wood with defects which will render a piece unable to serve its intended function. Lumber will be rejected by consultant for excessive warp, twist, bow, crook, mildew, fungus or mould as well as for improper cutting and fitting, whether or not it has been installed.

##### 1.4 ENVIRONMENTAL REQUIREMENTS

- .1 When it is required that wood maintain dimensional stability and tolerances to ensure accurate installation of later work, store and install in only in dry areas, and where no further installation of moist materials is contemplated.

##### 1.5 DELIVERY, STORAGE AND PROTECTION

- .1 Provide dry storage areas for rough carpentry materials. Stack lumber 6" (150mm) clear of floor. Cover materials with tarpaulins or polyethylene sheets to prevent moisture absorption and

impairment of structural and aesthetic properties. Vent to allow air movement. Tie covering to keep in place.

## 2. PRODUCTS

### 2.1 MATERIALS

- .1 Wood Materials: Straight, sawn square, true, dressed four sides, properly sized and shaped to correct dimensions from nominal sizes indicated or specified.
- .2 Lumber Grade and Moisture Content: Comply with official grading rules of NLGA for the particular lumber and grade, and structurally complying with the latest requirements of the NBC. Use only grade marked lumber.
- .3 Maximum Moisture Content of Lumber: 19% for exterior work.
- .4 Softwood Lumber: Comply with CSA O141.
- .5 Douglas Fir Plywood: Complying with CSA O121, COFI Exterior.
- .6 Western Softwood Plywood: Complying with CSA O151, COFI Waterproof glue WSP. Poplar plywood: Complying with CSA O153 exterior waterproof type and interior moisture resistant type. Exposed two sides shall be Grade G2S, and exposed one side shall be Grade G/Solid.
- .7 All Wood Materials: Well seasoned, free from defects that would impair strength or durability.
- .8 Blocking, Concealed Framing, Cant Strips, Grounds, Nailing Strips: No. 2 Ontario White Pine, No. 2 Red Pine, or Construction No. 1 Jack Pine, all complying with the grading rules of NLGA, or Construction Douglas Fir complying with COFI standard grading and dressing rules.
- .9 Wood Preservative: Complying with CSA O80 containing 5% pentachlorophenol, Solignum by Sturgeons Ltd., Rez Sanding Sealer by Monsanto Co. Ltd., Pentox by Osmose Wood Preserving Co. of Canada Ltd., or other approved manufacture. For painted surfaces use clear type, for concealed surfaces use green tinted type.
- .10 Rough Hardware: Nails, screws, bolts, lag screws, anchors, special fastening devices and supports as required for the erection of all rough carpentry items as follows:
  - .1 Nails, spikes and staples: CSA B111; spiral type.
  - .2 Bolts: ASTM A325; ½" diameter minimum with nuts and washers unless otherwise noted.
  - .3 Screws: Countersunk head, full thread type.
  - .4 Proprietary fasteners: toggle bolts, expansion shields, lag bolts, screws, inorganic fibre plugs, recommended for purpose by manufacturer.
  - .5 Galvanize rough hardware exposed to the atmosphere in accordance with CAN/CSA G164-M.
- .11 All wood and wood products to be free of formaldehydes and other chemicals that may adversely affect the indoor air quality in the school.

### 2.2 FABRICATION

- .1 Treat wood in contact with masonry, or concrete with wood preservative before setting in place. Apply preservative in accordance with the manufacturer's written instructions.
- .2 Design construction details for expansion and contraction of materials.

3. EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Provide running members of the longest lengths obtainable and with square ends.
- .2 Brace work temporarily as required. Join work only over solid backing.
- .3 Erect work plumb, level, square and to the required lines.
- .4 Do not regard blocking, strapping and other rough carpentry indicated as complete or exact. Provide rough carpentry items required for the installation of the work of other Sections.
- .5 Set and secure wood level, plumb and to correct locations indicated on Drawings. Ensure horizontal bowing is kept to a minimum.
- .6 Shim members as required to provide a true, plumb and exact location. Shim up where required to ensure proper alignment dimensions.
- .7 Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates or washers for bolt head and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of work.

3.2 INSTALLATION – ROUGH HARDWARE

- .1 Supply and install rough hardware.
- .2 Provide fasteners long enough so that at least half their length penetrates into the second member and as recommended by COFI. Minimize splitting of wood members by staggering the fasteners in the direction of the grain and by keeping fasteners well in from edges.
- .3 Fasten to hollow masonry units with toggle bolt, to solid masonry or concrete with lead expansion shields and lag screws. Do not use organic fibre or wood plugs

3.3 APPLICATION – WOOD PRESERVATIVE

- .1 Treat wood in contact with masonry or concrete with wood preservative before setting in place. Apply preservative in accordance with the manufacturer's written instructions.

END OF SECTION 06 10 00

## **DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES**

### Section 06 16 00 – Exterior Gypsum Sheathing

#### 1. GENERAL

##### 1.1 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Work Covered by the Contract Documents.
- .2 Provide all labour, materials, products, equipment and services to complete the exterior gypsum sheathing work specified herein. This includes, but is not necessarily limited, to:
  - .1 Exterior gypsum sheathing boards
  - .2 Joint treatments
  - .3 Auxiliary materials the rough carpentry indicated on the Drawings and specified herein and/or necessary.

##### 1.2 RELATED SECTIONS

- .1 Section 01 11 13 – Work Covered by the Contract Documents
- .2 Section 07 21 00, Building Insulation
- .3 Section 07 27 00.01, Air Barriers
- .4 Section 07 27 23, Board Product Air Barriers

##### 1.3 REFERENCES

- .1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of Bid Closing Deadline of the Project, including any amendments adopted, are applicable unless otherwise indicated.

##### 1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
  - .1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties.
- .2 Coordination: Coordinate Work of this Section as required to permit pre-fabrication where indicated or required by project requirements or Contract Documents.

##### 1.5 SUBMITTALS

- .1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with submittal requirements.
  - .1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

- .2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual for adhesives, sealants and any other material designated by Consultant.
- .3 Shop Drawings: Submit Shop Drawings indicating material characteristics, details of construction, in particular locations of construction joints, connections, and relationship with adjacent construction. Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work.

## 1.6 QUALITY ASSURANCE

- .1 Installer Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified.

## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## 2. PRODUCTS

### 2.1 MANUFACTURERS

- .1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
  - .1 CertainTeed Gypsum Canada Inc.; [www.certainteed.com](http://www.certainteed.com)
  - .2 CGC Inc; [www.cgcinc.com](http://www.cgcinc.com)
  - .3 Georgia-Pacific Canada, Inc.; [www.gpgypsum.com](http://www.gpgypsum.com)

### 2.2 REGULATORY REQUIREMENTS

- .1 Fire-Resistance-Rated Assemblies: Where fire-resistance-rated assemblies are noted on Drawings, provide materials and construction identical to those tested in assembly indicated on Drawings and Schedules according to CAN/ULC-S101 or equivalent to ASTM E119 by an independent testing agency

### 2.3 DESIGN AND PERFORMANCE REQUIREMENTS

- .1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.
- .2 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of National Building Code of Canada and CAN/CSA S832

### 2.4 MATERIALS

- .1 Exterior Gypsum Sheathing Board: glass mat reinforced, weather and sag resistant exterior gypsum ceiling panel conforming to ASTM C1177M with following characteristics:
  - .1 Type and Thickness: Type X, 15.9 mm (5/8 inch) thick.

- .2 Size: 1220 by 2440 mm (48 by 96 inches) as required for vertical installation.
- .3 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.
- .4 Fire-performance: noncombustible according to ASTM E136/CAN/ULC-S114; flame spread: 0, smoke developed: 0 in accordance with ASTM E84/CAN/ULC-S102-M.
- .2 Boards containing paper or other organic materials in their composition are not acceptable.
- .3 Acceptable Products:
  - .1 "DensGlass Exterior Sheathing" by Georgia-Pacific Canada, Inc.
  - .2 "GlasRoc® Sheathing" by CertainTeed Gypsum, Canada Inc.
  - .3 "Securock Glass Mat Sheathing" by CGC Inc.
  - .4 Air-Barrier/Water-Resistant Glass-Mat Gypsum Sheathing.

## 2.5 ACCESSORIES

- .1 Provide auxiliary materials that comply with referenced installation standards.
- .2 Fasteners: Provide fasteners of size and type indicated that comply with requirements specified in this Section for material and manufacture.
  - .1 For sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
- .3 Provide steel drill screws, complying with ASTM C954 in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- .4 Joint Treatments: Conforming to ASTM C475 and exterior gypsum sheathing board manufacturer's recommendations.
  - .1 Sealant for Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 90 00.

## 3. EXECUTION

### 3.1 EXAMINATION

- .1 Examine substrate for compliance with applicable requirements, including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
- .2 Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation implies acceptance of substrate conditions.

### 3.2 INSTALLATION

- .1 Comply with requirements in ASTM C1280 that apply to application of exterior gypsum panel products.
- .2 Fasten gypsum sheathing to cold-formed metal framing with screws.

- .3 Install boards with a 9-mm (3/8-inch) gap where non-load-bearing construction abuts structural elements.
- .4 Install boards with a 6-mm (1/4-inch) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- .5 Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- .6 Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- .7 Securely attach to substrate by fastening as indicated on reviewed Shop Drawings. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevents exterior moisture from passing through completed assembly.
- .8 Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- .9 Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
- .10 Space fasteners approximately 200 mm (8 inches) o.c. and set back a minimum of 9.5 mm (3/8 inch) from edges and ends of boards.
- .11 Seal sheathing joints according to sheathing manufacturer's written instructions.
  - .1 Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
  - .2 Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant.
  - .3 Taping of joints may be omitted provided exterior sheathing boards have square edges and is installed tightly butted together i.e. maximum 6 mm (1/4 inch) gap. Provide taping in locations where tight butting of joints cannot be achieved.
  - .4 Consultant reserves the right to request that joints be taped should the aforementioned quality control measures not be maintained.

### 3.3 CLEANING

- .1 Cooperate and coordinate with other Sections to obtain satisfactory exterior gypsum sheathing board finish work.
- .2 Clean droppings and similar items and remove surplus materials and rubbish on completion and as directed.

END OF SECTION 06 16 00



## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 20 00 – Air Barrier/ Vapour Retarder

#### 1. GENERAL

##### 1.1 SECTION INCLUDES

- .1 Self Adhering Membrane
- .2 Trowel Applied Membranes

##### 1.2 RELATED SECTIONS

- .1 Section 01 11 13 – Work Covered by the Contract Documents
- .2 Section 04 90 00 – Masonry
- .3 Section 07 20 10 – Through-wall Flashing Membrane
- .4 Section 07 21 13 – Insulation Board
- .5 Section 07 62 00 – Sheet Metal Flashing And Trim
- .6 Section 07 90 00 – Sealant

##### 1.3 REFERENCES

- .1 CAN/CGSB 51.32-M77: Sheathing, Membrane, Breather Type.
- .2 CAN/CGSB 51.33-M89: Vapour Barrier Sheet, Excluding Polyethylene, for use in Building Construction.
- .3 CAN/CGSB 51.34-M86: Vapour Barrier, Polyethylene Sheet, for use in building construction.

##### 1.4 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Building Envelope Work Covered by the Contract Documents.
- .2 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, permits, authorization from utilities, protection of adjacent wall and roof areas, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.
- .3 This section shall include all accessories necessary to complete the work, tie-ins to adjacent systems, and modifications to existing systems.
- .4 Where conflict exists in the scope of work, requirements, standards, or codes, the most stringent criteria shall apply.

##### 1.5 SUBMITTALS

- .1 Submit manufacturer's Product data in accordance indicating the products characteristics, performance criteria, and limitations. Indicate surface preparation requirements, installation requirements and techniques, product storage, and handling criteria.
- .2 Submit the information directly to the Consultant.

##### 1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with product manufactures instructions. Maintain Manufacturer's installation guides on-site.

- .2 Pre-installation meeting: Arrange with manufacturer's representative to inspect substrates and review installation procedures 48 hours in advance of installation.

#### 1.7 QUALIFICATIONS

- .1 The installer shall be a company specializing in performing the work of this section with a minimum of five (5) years proven experience for projects of similar size and complexity.
- .2 Use single Contractor for all air barrier/vapour retarder membrane installation.

#### 1.8 MOCK-UP

- .1 Construct a typical mock-up two (2) weeks prior to commencing with the work at a location agreed with the Consultant to show surface preparation, priming, air barrier/vapour retarder installation and bond and interfaces with adjacent walls, roofs and the like. The mock-up shall be at least 1m by 1m.
- .2 Upon receipt of written confirmation from the Consultant, the mock-up may remain as part of the finished work.
- .3 The Contractor must receive written confirmation of the mock-up acceptance prior to commencing with the work.
- .4 Approved mock-up shall serve as the standard to which all related work shall be evaluated.
- .5 Rejected mock-ups will be removed and disposed of at the expense of the Contractor.
- .6 The mock-up shall be completed using the products.

#### 1.9 DELIVERY, STORAGE AND PROTECTION

- .1 Provide weather protection and construction protection in accordance with CAN3-S304.
- .2 Keep the materials dry and protected from the weather, freezing and contamination.
- .3 Ensure that the labels and seals on all materials are intact upon delivery.
- .4 Remove rejected or contaminated materials from the site.

#### 1.10 WARRANTY

- .1 Defective work shall include, but is not limited to loss of adhesion, loss of cohesion, discolouration, and premature deterioration.

#### 1.11 ENVIRONMENTAL REQUIREMENTS

- .1 All work shall be performed in strict accordance with manufacturer's written requirements for all products specified in the specification.
- .2 Should a conflict arise between the requirements of this section and the manufacturer's requirements, the more stringent requirements shall govern.

#### 1.12 EXISTING CONDITIONS

- .1 The Contractor shall provide all required support to safely support all the loads.
- .2 Report, in writing to the Consultant, any conditions which will adversely affect the work of this section.

#### 1.13 ALTERNATIVES

- .1 Alternatives to manufacturer's brands or supply sources of materials will not be accepted.

## 2. PRODUCTS

### 2.1 SELF ADHERING AIR BARRIER / VAPOUR RETARDER MEMBRANE

- .1 Modified bitumen membrane reinforced with non-woven polyester mat, self adhesive type membrane covered with plastic film on one side, self adhesive polyethylene protective film on the other. Minimum thickness 1.0 mm (41 mils)
  - .1 Acceptable Products: Blueskin SA as manufactured by Henry
  - .2 Primer: as per the manufacturer.
- .2 Flashing Sealant: BES 925 by Henry.

### 2.2 TROWEL APPLIED AIR BARRIER/VAPOUR RETARDER MEMBRANE

- .1 For laps, seams, end dams, breaches and penetrations:
  - .1 Liquid air/vapour barrier; synthetic, trowel applied to a wet film thickness of 3mm, rubber based adhesive type. Maximum Air Leakage: 0.013 L/s/m<sup>2</sup> @ 100 Pa.; 0.027 L/s/m<sup>2</sup> @ 500 Pa., 0.075 L/s/m<sup>2</sup> @ 3000 Pa. Maximum Water vapour permeance: 1.7 ng/Pa.m<sup>2</sup>.s. (0.03 perms).
  - .2 Acceptable Product: Air-Bloc 21 as manufactured by Henry.

### 2.3 TRANSITION (TIE-IN) MEMBRANE

- .1 SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film. Minimum thickness 1.0 mm.
  - .1 Acceptable Product: Blueskin SA as manufactured by Henry
- .2 Transition Sealant: BES 925 by Henry. All transition seams to receive flashing sealant.

### 2.4 METAL SUPPORT

- .1 26 gauge galvanized sheet metal. Profile as per the details.

### 2.5 FASTENERS

- .1 Concrete Substrate: Stainless steel concrete screw, 3/16" diameter, 1-1/4" length - flat head.

## 3. EXECUTION

### 3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.
- .2 Commencing with the installation means acceptance of the existing substrates by the Contractor.
- .3 Work is not to proceed without a letter from membrane manufacturer outlining site specific recommendations.

### 3.2 PREPARATION

- .1 Protect adjacent finished materials from marking or damage due to the work.
- .2 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, corrosion by-product or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush.

- .3 Newly placed materials containing moisture (i.e. concrete, mortar etc.) should be cured for a minimum of 14 days and must be dry before membranes are applied.
- .4 Install temporary shoring, bracing or other supports as necessary to support loading in the area of work.
- .5 Incomplete areas of work shall be completely covered and protected with non-staining waterproofing covers when the construction is not in process. Joints between panels of exterior grade gypsum, plywood and other panel type substrates shall be sealed with a self-adhering membrane lapped a minimum of 75 mm on both sides of the joint prior to the application of liquid membrane. Cracks in masonry and concrete shall be sealed with a strip of self-adhered membrane lapped a minimum of 75 mm on both sides of the crack applied to the substrate prior to the application of liquid membrane.
- .6 Remove the existing self-adhered membrane where no longer adhered, where wrinkles, air pockets, etc. exist, where there is water behind the membrane, and where directed by the Consultant. The remaining existing self-adhered membrane must be well adhered.

### 3.3 PRIMER FOR ALL SELF-ADHERING MEMBRANE

- .1 Obtain from the manufacturer a letter regarding whether primer is required on an existing self-adhered membrane.
- .2 All substrate surfaces are to be primed unless directed by the manufacturer.
- .3 Apply primer for self-adhering membrane and through-wall flashing membrane at the rate recommended by manufacturer.
- .4 Apply primer by either roller or spray and allow minimum 30 minute open time. Primed surfaces not covered with membrane during the same working day must be re-primed.

### 3.4 SELF-ADHERING MEMBRANE INSTALLATION

- .1 Apply the membrane to the prepared and primed substrate in an overlapping shingle fashion, and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
- .2 Align and position the membrane, remove protective film and press firmly in place. Ensure a minimum of 75 mm overlap at all end and side laps. Promptly roll all laps and membrane with a counter top roller to promote adhesion.
- .3 At the end of each day's work, seal the top edge of the membrane where it meets the substrate using the flashing sealant or as recommended by the manufacturer.
- .4 At all such locations provide membrane end dams with metal support.
- .5 Terminate the membrane at the toe of the shelf angle and 38 mm beyond the edge of the metal support.
- .6 Ensure all projections, breaches and penetrations, including wall ties, seams, joints, end, etc. are properly sealed with an application of a trowel applied air barrier.
- .7 Provide a flashing sealant bead between the underside of the membrane and the support (shelf angle or metal support).

### 3.5 TRANSITION (TIE-IN) MEMBRANE

- .1 Fully remove the existing sealants and transition membranes. Clean the substrate with MEK and prepare to receive new transition membrane.
- .2 Align and position transition membrane, remove protective film and press firmly into place. Ensure minimum 75mm overlap at all end and side laps. No wrinkles will be tolerated. Seal seam with lap sealant.
- .3 Tie-in to window frames, aluminum screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials.
- .4 Promptly roll all laps and membrane with a counter top roller to affect seal.

3.6 Ensure all preparatory work is complete prior to applying primary liquid/trowel applied air vapour barrier membrane.

### 3.7 THROUGH-WALL FLASHING MEMBRANE INSTALLATION

- .1 Refer to Section 07 20 10 – Through Wall Flashing Membrane Installation.

### 3.8 TROWEL APPLIED MEMBRANE INSTALLATION

- .1 Apply by flat trowel a complete and continuous unbroken film of membrane to the specified thickness.
- .2 Overlap transition membrane a minimum of 25 mm.
- .3 Trowel around all projections ensuring a complete and continuous air seal. Ensure protrusions such as brick ties are properly sealed with membrane at the point of contact with the wall.

### 3.9 PROTECTION

- .1 The membranes specified in this section are not designed for permanent exposure. Ensure that membranes are covered promptly after completing the work.
- .2 Contractor must maintain the exterior walls watertight at all times to prevent moisture penetration into the wall fabric. The Contractor shall be responsible for all costs associated with damage associated with moisture penetration resulting from inadequate protection as determined by the Consultant.

END OF SECTION 07 20 00

## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 20 00 – Through-Wall Flashing Membrane

#### 1. GENERAL

##### 1.1 SECTION INCLUDES

- .1 Self Adhering Membranes
- .2 Trowel Applied Membranes
- .3 Accessories

##### 1.2 RELATED SECTIONS

- .1 Section 01 11 13 – Work Covered by the Contract Documents
- .2 Section 04 90 00 – Masonry
- .3 Section 07 20 00 – Air Barrier Vapour Retarder
- .4 Section 07 21 13 – Board Insulation
- .5 Section 07 90 00 – Sealant

##### 1.3 REFERENCES

- .1 CAN/CGSB 51.32-M77: Sheathing, Membrane, Breather Type.
- .2 CAN/CGSB 51.33-M89: Vapour Barrier Sheet, Excluding Polyethylene, for use in Building Construction.
- .3 CAN/CGSB 51.34-M86: Vapour Barrier, Polyethylene Sheet, for use in building construction.

##### 1.4 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Work Covered by the Contract Documents.
- .2 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, permits, authorization from utilities, protection of adjacent wall and roof areas, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.
- .3 This section shall include all accessories necessary to complete the work, tie-ins to adjacent systems, and modifications to existing systems.
- .4 Where conflict exists in the scope of work, requirements, standards, or codes, the most stringent criteria shall apply.

##### 1.5 SUBMITTALS

- .1 Submit manufacturer's Product data in accordance indicating the products characteristics, performance criteria, and limitations. Indicate surface preparation requirements, installation requirements and techniques, product storage, and handling criteria.
- .2 Submit the information directly to the Consultant.

##### 1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with product manufactures instructions. Maintain Manufacturer's installation guides on-site.

- .2 Pre-installation meeting: Arrange with manufacturer's representative to inspect substrates and review installation procedures 48 hours in advance of installation.

#### 1.7 DELIVERY, STORAGE AND PROTECTION

- .1 Provide weather protection and construction protection in accordance with CAN3-S304.
- .2 Keep the materials dry and protected from the weather, freezing and contamination.
- .3 Ensure that the labels and seals on all materials are intact upon delivery.
- .4 Remove rejected or contaminated materials from the site.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- .1 All work shall be performed in strict accordance with manufacturer's written requirements for all products specified in the specification.
- .2 Should a conflict arise between the requirements of this section and the manufacturer's requirements, the more stringent requirements shall govern.

#### 1.9 EXISTING CONDITIONS

- .1 The Contractor shall provide all required support to safely support all the loads.
- .2 Report, in writing to the Consultant, any conditions which will adversely affect the work of this section.

#### 1.10 ALTERNATIVES

- .1 Alternatives to manufacturer's brands or supply sources of materials will not be accepted.

### 2. PRODUCTS

#### 2.1 SELF ADHERING THROUGH-WALL FLASHING MEMBRANE

- .1 Modified bitumen membrane reinforced with non-woven polyester mat, self adhesive type membrane covered with plastic film on one side, self adhesive polyethylene protective film on the other. Minimum thickness 1.0 mm (41 mils)
  - .1 Acceptable Products: Blueskin TWF as manufactured by Henry Inc.
- .2 Primer: Aquatac Primer by Henry
- .3 Flashing Sealant: BES 925 by Henry.

#### 2.2 TROWEL APPLIED AIR BARRIER/VAPOUR RETARDER MEMBRANE

- .1 For laps, seams, end dams, and penetrations:
  - .1 Liquid air/vapour barrier; synthetic, trowel applied to a wet film thickness of 3mm, rubber based adhesive type. Maximum Air Leakage: 0.013 L/s/m<sup>2</sup> @ 100 Pa.; 0.027 L/s/m<sup>2</sup> @ 500 Pa., 0.075 L/s/m<sup>2</sup> @ 3000 Pa. Maximum Water vapour permeance: 1.7 ng/Pa.m<sup>2</sup>.s. (0.03 perms).
  - .2 Acceptable Product: Air-Bloc 21 as manufactured by Henry.

#### 2.3 METAL SUPPORT

- .1 26 Gauge Pre-finished aluminum sheet metal. Profile as per the details.

## 2.4 FASTENERS

- .1 Steel Stud Substrate: Organic-polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener size to suit.
  - .1 Acceptable Products: Wind-lock Corporation "ci-Lock Steel Series Selection" with 1-3/4 inch diameter high-grade plastic washers.
- .2 Concrete Substrate: Stainless steel concrete screw, 3/16" diameter, 1-1/4" length - flat head.

## 2.5 SHELF ANGLE COATING

- .1 Acceptable system by International Paint:
  - .1 Pre-prime 167 (1.0 wet mill thickness) (where full cleaning cannot be achieved).
  - .2 Bar Rust 235 (8.8 wet mill thickness).
  - .3 Devthane 379 (3.2 wet mill thickness).
  - .4 Clean surface to St2 or SSPC-SP2.

## 3. EXECUTION

### 3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.
- .2 Commencing with the installation means acceptance of the existing substrates by the Contractor.

### 3.2 PREPARATION

- .1 Protect adjacent finished materials from marking or damage due to the work.
- .2 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, corrosion by-product or other contaminants.
- .3 Newly placed materials containing moisture (i.e. concrete, mortar etc.) should be cured for a minimum of 14 days and must be dry before membranes are applied.
- .4 Install temporary shoring, bracing or other supports as necessary to support loading in the area of work.
- .5 Incomplete areas of work shall be completely covered and protected with non-staining waterproofing covers when the construction is not in process.

### 3.3 SHELF ANGLE COATING

- .1 Remove existing TWF membrane from the shelf angles. Clean all exposed surfaces included the underside of the horizontal leg to the minimum requirements by the coating manufacturer.
- .2 Install new coating system.
- .3 Allow a minimum of 14 days cure time or as long as recommended by the manufacturer prior to proceeding with the TWF installation.

### 3.4 THROUGH-WALL FLASHING MEMBRANE SUPPORT

- .1 Install the metal support securely fastened to the back-up wall and interfacing substrates. Set the metal support in a full bed of flashing sealant.



- .2 Ensure that work associated with the shelf angles and the metal support is complete prior to proceeding with the through-wall flashing membrane work.

### 3.5 PRIMER (SELF-ADHERING THROUGH-WALL FLASHING MEMBRANE)

- .1 Apply primer for self-adhering membrane at the rate recommended by manufacturer.
- .2 Apply primer by either roller or spray and allow minimum 30 minute open time. Primed surfaces not covered with membrane during the same working day must be re-primed.

### 3.6 SELF ADHERING THROUGH-WALL FLASHING MEMBRANE INSTALLATION

- .1 Provide a minimum of 150 mm overlap onto the existing wall membrane.
- .2 Apply the membrane to the prepared and primed substrate in an overlapping shingle fashion, and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
- .3 Align and position the membrane, remove protective film and press firmly in place. Ensure a minimum of 50 mm overlap at all end and side laps. Promptly roll all laps and membrane with a counter top roller to promote adhesion.
- .4 When through-wall flashing membrane is applied on top of existing primed and prepared existing wall membrane (air barrier/vapour retarder), ensure to seal the top edge and other leading edge of the membrane where it meets the substrate using the flashing sealant or as recommended by the manufacturer.
- .5 At the end of each days work, seal the top edge of the membrane where it meets the substrate using the flashing sealant or as recommended by the manufacturer.
- .6 Provide transitions to each adjacent system as shown on the drawings. Tie-in to window frames, hollow metal doorframes, adjacent wall systems, roofing system and at the interface of dissimilar materials as indicated in drawings. Refer to manufacturer's standard details.
- .7 Provide end dams complete with metal support where required as shown on the drawings.
- .8 Terminate the membrane at the toe of the shelf angle and 38 mm beyond the edge of the metal support as per the details.
- .9 Ensure all projections or penetrations, including wall ties, seams, joints, end, etc. are properly sealed with an application of a trowel applied air barrier.
- .10 Provide a flashing sealant bead between the underside of the membrane and the support (shelf angle or metal support).

### 3.7 TROWEL APPLIED MEMBRANE INSTALLATION

- .1 Apply by flat trowel a complete and continuous unbroken film of membrane to the specified thickness.
- .2 Overlap transition membrane a minimum of 25 mm.
- .3 Trowel around all projections ensuring a complete and continuous air seal. Ensure protrusions such as brick ties are properly sealed with membrane at the point of contact with the wall.

3.8      PROTECTION

- .1      The membranes specified in this section are not designed for permanent exposure. Ensure that membranes are covered promptly after completing the work.
- .2      Contractor must maintain the exterior walls watertight at all times to prevent moisture penetration into the wall fabric. The Contractor shall be responsible for all costs associated with damage associated with moisture penetration resulting from inadequate protection as determined by the Consultant.

END OF SECTION 07 20 00

## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 21 29 – Sprayed Insulation

#### 1. GENERAL

##### 1.1 SECTION INCLUDES

- .1 Spray applied polyurethane foam.
- .2 Intumescent Thermal Barrier Coating

##### 1.2 RELATED SECTIONS

- .1 Section 07 81 00 – Applied Fireproofing

##### 1.3 REFERENCES

- .1 CAN/ULC-S705.1-01, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification
- .2 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application
- .3 CAN/ULC S711.1 Standard for Thermal Insulation – Bead-Applied Two Component Polyurethane Air Sealant foam Part 1: Material Specification
- .4 CAN/ULC S711.1 Standard for Thermal Insulation – Bead-Applied Two Component Polyurethane Air Sealant foam Part 1: Material Specification

##### 1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting minimum one (1) week prior to beginning the work of this Section, with Consultant and TDSB Project Supervisor to:
    1. Verify project requirements.
    2. Review installation and substrate conditions.
    3. Co-ordination with other construction subtrades.
    4. Review mock-ups and procedures.
    5. Review manufacturer's written installation instructions and warranty requirements.

##### 1.5 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Building Envelope Work Covered by the Contract Documents.
- .2 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, permits, authorization from utilities, protection of adjacent wall and roof areas, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.

- .3 This section shall include all accessories necessary to complete the work, tie-ins to adjacent systems, and modifications to existing systems.
- .4 Where conflict exists in the scope of work, requirements, standards, or codes, the most stringent criteria shall apply.

## 1.6 SUBMITTALS

- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for spray applied foam product and include product characteristics, performance criteria, and limitations.
  - .2 Manufacturer's product sheet to describe:
    - 1. Typical Physical Properties
    - 2. Air Barrier Testing Results
    - 3. Long-Term Thermal Resistance
    - 4. Packaging and Storage Recommendation
    - 5. Approvals and Credentials
    - 6. Health & Safety Considerations and Precautions/Limitations
  - .3 Submit two (2) copies of WHMIS MSDS to the Consultant and TDSB Project Supervisor.
- .2 CLOSEOUT SUBMITTALS
  - .1 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  - .2 Warranty Documentation: submit warranty documents specified.

## 1.7 QUALITY ASSURANCE

- .1 Perform the work in accordance with the manufacturer's written project recommendations.
- .2 Qualifications:
  - .1 The installation of the spray applied foam shall be performed by a recognized specialized applicator, having at least five (5) years of experience, with skilled mechanics, thoroughly trained and competent in all phases of the work.
- .3 Mock-Up:
  - .1 Provide site mock-up for work of this Section indicating methods and materials, and procedures proposed to achieve final results and to comply with following requirements, using materials indicated for completed work:
    - 1. Perform mock-ups in location and of size as directed by Consultant.
  - .2 Mock-up to include review of:
  - .3 Substrate preparation
  - .4 Spray foam application – including multiple lifts where required

- .5 Spray foam coverage and thickness
- .6 Intumescent thermal barrier coating application over spray foam.
- .7 The Contractor is to provide adequate notice to allow for review of the mock-up by the Consultant.
- .8 Upon receipt of written confirmation from the consultant, the mock-up may remain as part of the finished work. The Contractor is to repair or replace unacceptable mock-ups at no additional cost to owner.
- .9 The approved mock-up shall be the standard to which all work shall be performed.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Protect products from physical damage and from deterioration due to moisture, soiling and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing and protecting during installation.
  - .2 Do not store at temperatures above 50 degrees Celsius or below 7 degrees Celsius. Avoid prolonged storage in direct sunlight or near heat sources.
  - .3 Replace defective or damaged materials with new.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply materials when temperature or weather conditions exceed manufacturer's recommendations.
- .2 Comply with manufacturer's recommended requirements for temperatures, relative humidity, and substrate moisture content during application and curing of materials.

#### 1.10 WARRANTY

- .1 Manufacturer's warranty: Submit, for Consultant acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty in addition to and not limit other rights Owner may have under Contract Documents.
- .2 The Contractor is to warrant work of this Section against defects and deficiencies for a period of five (5) years from the date the Work is certified as substantially performed in accordance with the General Conditions of the Contract and as amended by the Supplementary General Conditions.
  - .1 The Contractor is to promptly correct deficiencies which become apparent within the warranty period without cost to the Owner. Defects shall include, but not limited to:
    - 1. Inadequate application thickness leading to reduced insulation efficiency
  - .2 Improper installation around electrical fixtures or plumbing, posing potential fire and safety hazards.
  - .3 Potential shrinkage or expansion of the foam due to improper curing processes

## 2. PRODUCTS

### 2.1 SPRAYED APPLIED POLYURETHANE FOAM

- .1 Insulation / Air Barrier Material: Closed cell, spray applied polyurethane foam (ccSPF), medium density, meeting the requirements of CAN/ULC-S705.1-15 as confirmed by the CCMC listing #14100-L. LTRR values as tested to CAN/ULC S770-09, GREENGUARD Gold (ULE) Certified. Product to utilize Low GWP (Global Warming Potential) HFO blowing agent.
- .2 Spray-applied Polyurethane Insulation: WALLTITE v5 by BASF and Represented by Building Resource Inc. [www.buildingresource.ca](http://www.buildingresource.ca)

### 2.2 INTUMESCENT THERMAL BARRIER COATING

- .1 Spray applied intumescent thermal barrier coating meeting the requirements of classification B when tested in conformance with CAN/ULC-S124, "Test for the Evaluation of Protective Coverings for Foamed Plastic" as referenced in the OBC Sentence 3.1.5.12A.(2) and Certified for Canada as confirmed by a current UL Listing. Finish is white with a semi-gloss sheen.
- .2 Thermal Barrier for the protection of Spray Polyurethane Foam: Flame Seal-TB-C™ Manufactured by Flame Seal Products Incorporated and represented by Building Resource Inc [www.buildingresource.ca](http://www.buildingresource.ca) UL CAW07.R38231

### 2.3 PRIMER

- .1 As recommended by spray applied foam manufacturer.

### 2.4 CLEANING AGENT

- .1 Non-corrosive type recommended by spray applied foam manufacturer.

## 3. EXECUTION

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for spray applied foam installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant and ensure they are suitable for product application.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### 3.2 SPRAY FOAM INSTALLATION – GENERAL

- .1 Install materials in strict compliance with manufacturer's written installation instructions, when ambient temperature is between 15-27 degrees Celsius. Application is permitted at an ambient temperature as low 0 degrees Celsius and rising, provided that temperature of kit contents is 25 degrees Celsius or greater.
- .2 Protect adjacent Work from damage and overspray of foam.

- .3 Do not apply spray applied polyurethane foam until preparatory work is completed, including but not limited to: installing all transition air seals (membranes and sealants) to create a continuous air barrier with the exterior wall assemblies, sealing of penetrations, etc.
- .4 After spray applied polyurethane foam is applied, make flush with finished surface (if required) by using method recommended by manufacturer.

### 3.3 INTUMESCENT THERMAL BARRIER COATING

- .1 Flame Seal TBC is installed by Flameseal Certified Applicators only. Apply in accordance with the written installation guide available at [www.flameseal.com](http://www.flameseal.com). Mix the 2 components together and apply 2 coats at 72 sq ft per US gallon per coat to achieve a total wet film thickness of 44 mils minimum.
- .2 Installers must complete a "JOB WORK RECORD" for each installation and submit it to Flame Seal.

### 3.4 FIELD QUALITY CONTROL

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits to review Work at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is completed, but before installation begins.
  - .2 Twice during progress of Work, at mock-up review and 60% complete.
  - .3 Upon completion of Work, after cleaning carried out.
  - .4 Obtain reports within 3 days of review and submit.

### 3.5 SCHEDULE

- .1 Interior Application of Spray Foam insulation on 1929 Masonry Walls
  - .1 2" (50mm)
- .2 Interior Application of Spray Foam Insulation on 1954, 1961 and 1966 Masonry Walls
  - .1 4" (100mm)
- .3 Interior Application of Spray foam on Thermal Bridges:
  - .1 2" (50mm)
  - .2 Spray Foam Insulation to extend 4'-0" (1200mm) on all thermal bridging steel structure. This includes steel beams, steel columns, open web steel joists, steel decking, etc...
  - .3 Spray Foam Insulation to extend 2'-0" (600mm) on all thermal bridging masonry structure. This includes masonry partition walls that intersect exterior masonry walls which are insulated on the interior.

### 3.6 PROTECTION AND CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION



## Division 7 - THERMAL AND MOISTURE PROTECTION

### Sections 07 31 13 - Asphalt Shingles

#### 1.0 GENERAL

##### 1.1 SECTION INCLUDES

- .1 Materials, removal and installation of asphalt shingles and roll roofing for repairs.

##### 1.2 RELATED SECTIONS

- .1 Section [01 33 00 - Submittal Procedures].
- .2 Section [01 74 21 - Construction/Demolition Waste Management And Disposal].
- .3 Section [02 81 01 - Hazardous Materials].
- .4 Section [01 45 00 - Quality Control].
- .5 Section [01 61 00 - Common Product Requirements].
- .6 Section [01 78 00 - Closeout Submittals].

##### 1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-37.4-[M89], Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing.
  - .2 CAN/CGSB-37.5-[M89], Cutback Asphalt Plastic Cement.
  - .3 CAN/CGSB-51.32-[M77], Sheathing, Membrane, Breather Type.
  - .4 CAN/CGSB-51.34-[M86], Vapour Barrier Polyethylene Sheet, for Use in Building Construction.
- .2 Canadian Roofing Contractors' Association (CRCA).
  - .1 CRCA Roofing Specification Manual - 1997.
- .3 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-A123.1/A123.5-[98], Asphalt Shingles Made From Organic Felt and Surfaced With Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
  - .2 CSA A123.2-[M1979 (R2001)], Asphalt-Coated Roofing Sheets.
  - .3 CAN/CSA-A123.3-[98], Asphalt Saturated Organic Roofing Felt.
  - .4 CAN3-A123.51-[M85 (R2001)], Asphalt Shingle Application on Roof Slopes 1:3 and Steeper.
  - .5 CAN3-A123.52-[M85 (R2001)], Asphalt Shingle Application on Roof Slopes 1:6 to Less Than

1:3.

.6 CSA B111-[1974 (R1998)], Wire Nails, Spikes and Staples.

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

.1 Material Safety Data Sheets (MSDS).

.5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC).

.1 CCMC-[2002], Registry of Product Evaluations.

#### 1.4 SUBMITTALS

.1 Submit proof of manufacturer's CCMC Listing and listing number to the Owner and Consultant.

.2 Submit manufacturer's Product data in accordance indicating the products characteristics, colour and finish, performance criteria, limitations, special handling criteria, installation sequence and instructions, cleaning procedures and WHMIS MSDS - Material Safety Data Sheets.

.3 Submit the information directly to the Consultant.

#### 1.5 SAMPLES

.1 Submit duplicate samples of full-size specified shingles. Colour to be selected by Owner from a standard range of colours.

#### 1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with manufacturer's instructions.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Remove only in quantities required for same day use.

#### 1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Divert unused asphalt shingle materials from landfill to asphalt recycling facility approved by Consultant.

.5 Dispose of unused asphaltic cement type materials at official hazardous material collections site approved by Consultant.

.6 Fold up metal banding, flatten and place in designated area for recycling.

## 2.0 PRODUCTS

### 2.1 MATERIALS

- .1 Asphalt shingles: to CSA A123.1/A123.5. Colour, shape, and pattern to match existing shingles.
- .2 Asphaltic Cement:
  - .1 Plastic cement: to CAN/CGSB-37.5.
  - .2 Lap cement: to CAN/CGSB-37.4.

## 3.0 EXECUTION

### 3.1 APPLICATION

- .1 Do asphalt shingle work in accordance with CAN3-A123.51 except where specified otherwise.
- .2 Install drip edge along eaves, overhanging 12 mm, with minimum 50 mm flange extending onto roof decking. Nail to deck at 400 mm on centre.
- .3 Install bottom step flashing (soaker base flashing) interleaved between shingles at vertical junctions.
- .4 Install asphalt shingles on roof slopes 1:3 and steeper in accordance with CAN3-A123.51 supplemented as follows:

END OF SECTION 07 31 13

## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 42 13 – Metal Wall Panels

#### 1.0 GENERAL

##### 1.1 Description

###### .1 Work Furnished and Included:

- .1 Supporting sub-girts
- .2 Cladding Profile
- .3 Accessories including associated flashing, closures, sealants.

###### .2 Related work not included:

- .1 Structural framing members including purlins, eave and ridge elements, and other elements required to support the cladding system.
- .2 Doors, louvers, sashes, ventilators as well as their supporting framing.
- .3 Caulking of elements in 1.1.3.
- .4 Flashings associated with other trades.

##### 1.2 RELATED SECTIONS

- .1 Section 06 10 00 Exterior Gypsum Sheathing
- .2 Section 07 20 00 Air Barrier Vapour Retarder
- .3 Section 07 20 10 Through-wall Flashing Membrane
- .4 Section 07 62 00 Sheet Metal Flashing and Trim
- .5 Section 07 90 00 Sealant
- .6 Section 08 44 00 Curtain Wall and Glazed Assemblies Rehab

##### 1.3 GENERAL REQUIREMENTS

- .1 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, swing-stages, permits, authorization from utilities, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.

##### 1.4 REFERENCES

- .1 AAMA - American Architectural Manufacturers Association ([www.aamanet.org](http://www.aamanet.org))
  - .1 AAMA 2603 – Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - .2 AAMA 2604-13, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
  - .3 AAMA 2605-11, Voluntary Specification for Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .2 American Society for Testing and Materials International (ASTM).

- .1 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Material.
- .2 ASTM E136, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C.
- .3 ASTM E2768-11, Standard Test Method for Extended Duration Surface Burning Characteristics for Building Materials.
- .4 ASTM E283-04, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .5 ASTM E331-14, Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
- .6 ASTM E330-14, Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference (Modified).
- .3 Underwriters Laboratories Canada (ULC)
  - .1 CAN/ULC S114-05, Standard Test Method for Determination of Non-Combustibility in Building Materials.
  - .2 ULC-S135-04, Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter).
- .4 International Organization for Standardization (ISO)
  - .1 ISO 9227:1990, Corrosion Tests in Artificial Atmospheres – Salt Spray Tests.

#### 1.5 PERFORMANCE REQUIREMENTS

- .1 Maximum deflection not to exceed L/180 under system's own weight plus wind loads (positive and negative) prevalent for the location of the building, with loads acting normal to the plane in accordance with the Building Code Climatic Data, using 1-50 year probability factor.
- .2 Design cladding to span continuously over structural supports with fastening to structural supports to sustain factored loads in accordance with authority having jurisdiction.
- .3 Provide system to accommodate thermal movement of components and structural movements to provide an installation free of oil canning, wind rattle, buckling, failure of joint seals, and undue stress on fasteners.
- .4 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .5 Design system based on "Rain Screen Principle" per the National Research Council. Provide for positive drainage to the exterior of all water entering or condensation occurring within the system.

#### 1.6 SUBMITTALS

- .1 Four (4) weeks prior to starting the work, the contractor shall submit the following:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheets.
  - .2 Product Data: Submit manufacturer's product data, standard drawing details, and installation instruction for system and individual components.

- .1 Indicate arrangement of cladding system including dimensions, wall openings, location of joints, profiles of inner and outer skin, types and locations of supports, fasteners, flashing, closures, compliance with design criteria, and requirements of related work.
- .2 Shop Drawings must be accompanied by calculations completed by a Professional Engineer registered in the province of the project location.
- .3 Submit samples of siding material representative of colour/finish and profile specified.
- .4 Submit additional manufacturer's documentation:
  - .1 Preparation instructions and recommendations.
  - .2 Storage and handling requirements and recommendations.
  - .3 Installation instructions.
- .5 Close-out Submittals: Upon project completion, submit manufacturer's warranties, including limitations and conditions, and maintenance and cleaning instructions.

#### 1.7 QUALITY ASSURANCE

- .1 Testing Reports: Certified testing reports showing compliance with specified performance characteristics and physical properties, including laboratory reports showing compliance with specified tests and standards.
- .2 Installer Qualifications: Engage professional and experienced installer, with a minimum of 5 years experience, who has completed installation of systems similar in material, design, and extent to that indicated for Project and with successful performance record.
- .3 Pre-installation Meeting: Conduct pre-installation meeting to verify project drawings and requirements, manufacturer's installation instructions, and manufacturer's warranty requirements.
  - .1 Participants: General Contractor, Installation Subcontractor, Project Manager, Owner, and Consultant
  - .2 Verify project requirements.
  - .3 Review installation and substrate conditions.
  - .4 Coordination with other building subtrades whose work affects, or is affected by, the work of this Section, to conform to construction sequence, project schedule, and quality of workmanship.
  - .5 Review manufacturer's installation instructions and warranty requirements.
- .4 Mock-ups: Mock up complete cladding system at location as directed by Consultant.
  - .1 Construct a portion of one exterior wall in location agreed upon by Consultant as a free-standing mock-up, to establish a standard of construction, workmanship, and appearance.
  - .2 Construct mock-up indicating relationship between wall cladding, air spaces, air/vapour retarder membrane, windows, and doors.
  - .3 Do not continue with work of this Section until Consultant has approved mock-up.
  - .4 Remove free-standing mock-up upon completion of all cladding work or when otherwise directed by Consultant.

- .5 Conduct a site meeting upon completion of the project, before the installation subcontractor departs from site. Contractor and subcontractor will review any deficiencies. These deficiencies will be corrected before the departure of the installation subcontractor from job site.

#### 1.8 DELIVERY, STORAGE AND PROTECTION

- .1 Conform to manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- .2 Deliver materials and components in manufacturer's unopened cartons, properly labeled and fully identified by product name and brand. Prevent any damage during unloading, storing, and installation.
- .3 Store, protect, and handle materials and components in accordance with manufacturer's recommendations to prevent any damages.
- .4 Store materials off ground and keep clean, dry, and free of dirt and debris. Store away from areas with falling objects or other construction activity that may occur or cause damage.
- .5 Do not store cartons in stacks more than 6 cartons high. Prevent contact with materials capable of causing discolouration, staining, denting, or other surface damage.

#### 1.9 PROJECT/SITE CONDITIONS

- .1 Verify location of structural members, openings in substrates, and square footage area relating to this product, by field measurements, before ordering and fabrication of material. Coordinate fabrication and delivery schedule with construction progress to avoid delays.
- .2 Undertake installation work only when weather conditions meet manufacturer's environmental requirements and when conditions will permit work to be performed in accordance with manufacturer recommendations and warranty requirements.

#### 1.10 ALTERNATIVES

- .1 All requests for alternates on specified products in this section must be submitted to the Consultant. These requests must be accompanied by technical data sheets describing proposed product equivalency.

#### 1.11 CONSULTANT REVIEW

- .1 The Contractor shall provide access, permit inspection, correct any defects and obtain written approval to proceed from the Consultant prior to commencing with each phase of work.
- .2 The Consultant's general review during construction are undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.
- .3 The Contractor shall provide a third life line on each swing-stage at all times to facilitate the Consultant's review of the work.
- .4 Should additional work and/or visits by the Consultant be required because of the Contractor's failure to perform in accordance with the contract documents, or if additional design or drafting time is required by the Consultant to provide/review corrective measures caused by the Contractor's failure to perform in accordance with the contract documents, the Contractor shall reimburse the Consultant at the rate of direct personnel expense plus 150% overhead plus travel, equipment and material costs plus H.S.T. where applicable.

## 1.12 WARRANTY

- .1 All manufacturer's product warranties are against physical defects of systems and products that are properly installed and maintained according to the manufacturer's instructions and recommendations.
  - .1 LUXYLIFE™ lifetime (up to 50 years) limited warranty guarantees against buckling, warping, rusting, corroding, and defects in material or workmanship on aluminum siding and soffit.
  - .2 LUXYSHIELD™ 15-year limited finish warranty guarantees against cracking, chalking, colour retention, gloss retention, and adhesion.
- .2 Provide a signed copy of manufacturer's warranty with all necessary information filled out in the manufacturer's official form for warranty registration.

## 2.0 PRODUCTS

### 2.1 MANUFACTURER

- .1 Company: LUXYCLAD®,
  - .1 24 Benfield Drive, Building C, St. Catharines, ON, Canada, L2S 3V5.
  - .2 Tel: 1 877 255 1022,
  - .3 Web: www.luxyclad.com
- .2 Company: Vicwest Building Products
  - .1 5050 South Service Road, Burlington, ON L7L 5Y7
  - .2 Tel.800-265-8610
  - .3 Web: www.vicwest.com
- .3 Basis of Design: The drawing and specifications have been designed to conform to Vicwest Hidden Fastener Wal Cladding. Substitutions must be made 2 weeks in advance of the project bid date and for consideration. Without prior approval to the project bid date and an addendum issued to all bidders a substitution cannot be used.
- .4 Substitutions: To be considered for substitution prior to bid the product the Contractor must provide calculations that certify the product does meet the performance requirements in ASCE/SEI 7, a 3 year experience record with an equal system, and a full size sample for review.
- .5 The colour of the wall panels are to match existing as approved by the Owner. Custom colour may be required if the manufacturer's range of standard colours is not suitable.

### 2.2 EXTRUDED ALUMINIUM SIDING

- .1 6" V-Groove Siding
  - .1 Material: 6063-T5 alloy extruded aluminum
  - .2 Finish: Selected by owner's representative from manufacturer's range
    - .1 Solid colour and metallic finishes: Powder-coated finish [per AAMA 2604, AAMA 2605].
    - .2 Decorative finishes [i.e. wood grain]: Powder-coated base finish [per AAMA 2604, AAMA 2605] with sublimated finish.



- .3 Thickness: 11 gauge (aluminum)
- .4 Size: 6" (152.4mm) profile face @ 24' (7315.2mm) lengths
- .2 6" Channel Siding
- .3 Material: 6063-T5 alloy extruded aluminum
- .4 Finish: Selected by owner's representative from manufacturer's range
  - .1 Solid colour and metallic finishes: Powder-coated finish [per AAMA 2604, AAMA 2605].
  - .2 Decorative finishes [i.e. wood grain]: Powder-coated base finish [per AAMA 2604, AAMA 2605] with sublimated finish.
- .5 Thickness: 11 gauge (aluminum)
- .6 Size: 6" (152.4mm) profile face @ 24' (7315.2mm) lengths.

### 2.3 ACCESSORIES

- .1 Trim Pieces, 6063-T5 alloy extruded aluminum @ 12' (3657.6mm) lengths
  - .1 1.7" Flat Cap
  - .2 1.7" Flat Cap Base
  - .3 1.7" Finishing Strip Cap
  - .4 1.7" Finishing Strip Base
  - .5 J-trim
  - .6 1" Inside Corner Cap
  - .7 1" Inside Corner Base
  - .8 1.7" Outside Corner Cap
  - .9 1.7" Outside Corner Base
  - .10 1" Outside One Piece Corner
- .2 Other Components, 6063-T5 alloy extruded aluminum @ 12' (3657.6mm) lengths
  - .1 4" Splicer Support
  - .2 6" Splicer Support
  - .3 Starter Strip
- .3 Rain Screen Clips, 6063-T5 alloy extruded aluminum @ 1" (25.4mm) lengths
- .4 Touch Up Pen, Light or Dark Brown
- .5 Fasteners: 1-1/2" length, #8 screw with corrosion resistance suitable for the application and climate.
- .6 Girts: NV1-EF Thermally Broken Cladding Support System for Exposed Fastener Facade Attachment by NVELOPE Rainscreen Cladding Systems. Fabricated from 6005A-T6 aluminum with polypropylene thermal isolator and installed using Standard NVELOPE Fasteners as per manufacturer's documentation.

- .7 Insulation: Semi-rigid mineral wool batt insulation to CAN/ULC S702 Type 3, density of 70 kg/m<sup>3</sup>, RSI 0.74 per 25mm, meeting requirements of CAN/ULC S114-M non-combustible, total thickness as indicated on drawings.
- .8 Air Barrier: Self-adhering membrane as specified in Section 07 21 13.

#### 2.4 FABRICATION

- .1 Prepare surfaces, pre-treat, and coat components in accordance with AAMA 2604 and AAMA 2605 Quality Standards.
- .2 Fabricate and finish all extruded aluminum cladding profiles and accessories to highest quality and greatest possible extent, using manufacturer's standards, procedures, and processes. Comply with characteristics of indicated profiles with dimensional and structural requirements, and sufficient support and allowance for movement.
- .3 Fabricate entire cladding system true, plumb and square, with no oil-canning or deformity that detracts from aesthetic appearance, and with powder-coating and sublimation processes applied properly to manufacturer's standards.
- .4 Properly wrap and package product using methods suitable for transit and covered site storage without damage.

#### 3.0 EXECUTION

##### 3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.
- .2 Commencing with the installation means acceptance of the existing substrates by the Contractor.
- .3 Examine the areas and conditions under which the work will be performed. Review the planned operating procedures with the Consultant. Do not proceed with work until any unsatisfactory conditions are corrected in a manner acceptable to both the Owner and the Consultant.
- .4 Verify that the specified environmental conditions exist before commencing with the work.
- .5 The Contractor shall arrange for the sealant Manufacturer's representative to visit the site and review the surface preparation and installation procedures at the start of the work.

##### 3.2 INSTALLATION

- .1 Installation to be performed in accordance with Manufacturer's installation instructions and at the locations per the location plans provided by the manufacturer.

##### 3.3 PROTECTION

- .1 The Contractor is responsible for maintaining the work weather tight during the course of the project. At the end of each work day or when stoppage occurs, provide necessary protection to prevent water penetration through the exterior walls.
- .2 Seal and protect all openings, doors, windows and adjacent areas to minimize the potential for damage and the spread of dust, water or other materials into the building or adjacent sidewalks and properties.
- .3 Protect adjacent finished materials from marking or damage during the work.

- .4 Protect completed installation from damage resulting from construction operations or other causes such that panels are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, such sealant shall be rectified immediately.

END OF SECTION 07 90 00

## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 52 18 – Modified Bituminous Cold Applied Roofing

#### 1. GENERAL

##### 1.1 SCOPE OF WORK

- .1 Refer to Section 01 11 13 – Building Envelope Work Covered by the Contract Documents.
- .2 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, permits, authorization from utilities, protection of adjacent roof areas, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.
- .3 The Contractor shall take all reasonable measures and provide protection against damage to the building façade, structure, and interior finishes. All damage to the building resulting from this work will be repaired and/or rectified by the Contractor.
- .4 Work of this section includes all necessary equipment and accessories to perform modified bitumen roofing repairs where needed due to other building envelope modifications including but not limited to:
  - .1 Repairs to modified bitumen membranes at transitions between sloped roofing and flat roofing on the south side of the animal shelter.
  - .2 Repairs to concealed modified bitumen membranes at roof areas affected by envelope repairs.
- .5 This section shall include all accessories necessary to complete the work, tie-ins to adjacent systems, and modifications to existing flashings and finishes and roofing accessories to accommodate the masonry repairs.
- .6 Where conflict exists in the scope of work, requirements, standards, or codes, the most stringent criteria shall apply.
- .7 Modified bitumen upturns and transition details exist in locations across the building.

##### 1.2 ENVIRONMENTAL REQUIREMENTS

- .1 Membrane installation shall be performed only on a dry substrate, free of snow and ice. The Contractor shall use only dry materials and apply only during weather that will not introduce moisture into the system.
- .2 The Contractor shall ensure substrate temperature and moisture content conforms to manufacturer's minimum requirements, before proceeding with the work.
- .3 Roofing shall not be carried out when ambient temperatures are less than seven (7) degrees Celsius.

### 1.3 PERFORMANCE REQUIREMENTS

- .1 Install a watertight, modified bitumen membrane roofing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movements and exposure to weather without failure.
- .2 Install roofing to the standards of Canadian Roofing Contractors Association Metric Specification Manual (CRCA).
- .3 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, storage, handling and disposal of hazardous materials, and regarding labeling and the provision of material safety data sheets.

### 1.4 SYSTEM DESCRIPTION

- .1 Where repairs are necessary, as directed by the Consultant, provide 2 ply cold applied membrane roof system repairs over existing roof assemblies, including but not limited to following:
  - .1 Flat roofing assembly comprised of 4-ply roofing felt and gravel, existing modified bitumen roofing membrane tie-in, ½" fiber board, 3" tapered insulation, 3" rigid insulation, vapour barrier, ½" sheathing mechanically fastened to metal roof deck.
  - .2 Sloped roofing assemblies comprised of asphalt shingles, modified bitumen roofing membrane covering entire sloped roof, wood sheathing and roof structure.

### 1.5 REFERENCES

- .1 CSA - Canadian Standards Association
- .2 CGSB - Canadian General Standards Board
- .3 ULC - Underwriters Laboratories of Canada
- .4 ULI - Underwriters Laboratories Incorporated
- .5 FM - Factory Mutual Engineering Corporation
- .6 ASTM - American Society for Testing and Materials
- .7 CRCA - Canadian Roofing Contractors' Association
- .8 CWC - Canadian Wood Council
- .9 CSSBI - Canadian Sheet Steel Building Institute
- .10 OIRCA - Ontario Industrial Roofing Contractors' Association

### 1.6 SUBMITTALS BEFORE START OF WORK

- .1 Provide written verification from the roofing material manufacturer that all major roofing components originate from a single-source supplier, are compatible one to the other, and that the roofing system meets or exceeds regulatory agency requirements as specified.
- .2 Provide written verification from the roofing material manufacturer that the new roofing materials are compatible with the existing system(s).

- .3 Provide product data sheets and material Safety Data Sheets (MSDS) for all products to be used at the site and/or incorporated in the Work.

#### 1.7 QUALITY ASSURANCE

- .1 The installer shall be knowledgeable in the proper installation of the roofing and shall have a minimum of five (5) years of proven experience for projects of similar size and complexity.
- .2 The installer shall be approved, authorized, or licensed by the roofing system manufacturer to install the manufacturer's product and eligible to receive the standard manufacturer's warranty.
- .3 The Contractor shall provide the proper equipment, workers, and supervision on the job site to install the system in compliance with the project specifications.
- .4 The Contractor must employ a full-time on-site foreman for this Work who will be responsible for all aspects of this Work. Once established, the foreman is not to change for the duration of the Work unless previously approved by the Owner's Representative

#### 1.8 STORAGE AND HANDLING

- .1 Deliver and store all materials in their original unopened containers. The manufacturer's label intact and visible for review.
- .2 Store all materials in a safe, off ground, protected storage area to prevent damage. All materials must be protected from exposure to water and freezing. Maintain temperatures as per manufacturer's written instructions.
- .3 Store rolls of membrane in upright position. Always store on smooth, flat surfaces and avoid gravel surfaces.
- .4 All materials must be tarped to protect from water damage and ultraviolet deterioration.
- .5 Place plywood runways over work to enable movement of material and other traffic.
- .6 Store sealants at five (5) degrees Celsius minimum.
- .7 Store insulation protected from sunlight, weather and deleterious materials.
- .8 Damaged materials shall be removed and replaced with new materials, unless otherwise agreed with the Consultant.
- .9 Replace any materials damaged during manufacture, shipping, storage or installation.

#### 1.9 ALTERNATES

- .1 No requests for alternates on specified products will be considered.

#### 1.10 EQUIPMENT

- .1 Provide and maintain equipment such as ladders, scaffolds, railings, hoists, and the like as required for execution of the work.
- .2 Assume complete responsibility for construction strength, placing, anchoring and other mechanical contrivances used for the work. Ensure that the loads carried can be safely supported and free from accidents to all persons.

- .3 Comply with all safety regulations.
- .4 Remove immediately such equipment when not required for the remaining work.
- .5 Provide and maintain on site suitable fire extinguishers as required by the safety code.

#### 1.11 WARRANTY

- .1 Refer to Section 01 03 00, Building Envelope General Instructions for warranty requirements.

#### 1.12 CONSULTANT REVIEW

- .1 All shop and field materials and workmanship shall be subject to review by the Owner or their Representative at all times. These reviews shall not relieve the Contractor from the obligations to provide materials conforming to all requirements of the Contract Documents.
- .2 The Contractor shall provide access, permit inspection, correct any defects and obtain written approval to proceed from the Consultant prior to commencing with each phase of work.

#### 1.13 MANUFACTURER'S REPRESENTATIVE

- .1 The roofing product Manufacturer can delegate a representative to visit the work site at the start of roofing installation.
- .2 The Contractor must at all times enable and facilitate access to the work site by said representative.

#### 1.14 SAFETY AND REGULATORY REGULATIONS

- .1 At all times the Contractor and his personnel shall be completely familiar with, conform to, and enforce strict compliance with all relevant federal, provincial and local codes and regulations. These include, but are not necessarily confined to: Canadian Labour Code, Construction Safety Act, Ontario Occupational Health and Safety Act; Industrial Accident Prevention Association Regulations; Ontario Building Code; and the security requirements of the Owner.
- .2 All work will be carried out over a functioning museum gallery space. No action or omission shall be committed by the Contractor that would endanger employees of the Owner, its visitors or museum holdings, or place the Owner in violation of its obligations under the Occupational Health and Safety Act and Regulations made under the Act.
- .3 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, storage, handling and disposal of hazardous materials, and regarding labeling and the provision of material safety data sheets.
- .4 Arrange all work to minimize the inconvenience to building occupants and to the public.

- .5 Upon entry into the building, trades-persons working on this project will be required to be escorted by an Owner's representative to and from the site.

#### 1.15 SITE CONDITIONS

- .1 The Contractor shall provide all required support to safely support all the loads during the Work. Do not overload any area of the roof or building structure.
- .2 Report in writing to the Consultant any areas of deficiencies or changes in condition revealed that are not a part of this Work. Obtain the Consultant's approval and instruction prior to proceeding with the repair work in this area.
- .3 Do not install roofing during weather that might adversely affect the performance of the system.
- .4 Do not install roofing over surfaces that are wet, icy, dirty or otherwise unacceptable to the system being installed.
- .5 Remove only as much roofing as can be replaced in the same workday.
- .6 Secure the Work in a safe and watertight fashion before the onset of inclement weather and at the end of each day's work.
- .7 Protect walls where hoisting equipment and materials is necessary.
- .8 Post warning signs and barriers. Maintain in good order until completion of work.
- .9 Protect all public entrances to building where they are affected by the Work.

## 2. PRODUCTS

### 2.2 SBS MODIFIED BITUMINOUS SHEET

- .1 SBS Modified Bituminous Membrane Base Sheet and Base Sheet Flashing – SBS modified asphalt sheet smooth surfaced suitable for base sheet application. SBS Modified Bituminous Membrane Physical Properties:
  - .1 Minimum Thickness: 2.2 mm.
  - .2 Low Temperature Flexibility: Pass at -26 °C.
  - .3 Reinforcement: 180 g/m<sup>2</sup> Non-woven polyester.
  - .4 Top Face: Sanded.
  - .5 Under face: Sanded.
  - .6 Weight: 38 kg.
  - .7 Acceptable product:
    - .1 System 1: Modified PLUS NP180 as manufactured by Henry.



- .2 System 2: COLPLY BASE 410 as manufactured by Soprema.
- .3 System 3: POWERPLY 2PM as manufactured by Tremco Inc.
- .2 SBS Modified Bituminous Membrane Cap Sheet and Cap Sheet Flashing – SBS modified asphalt sheet sanded surfaced suitable for cap sheet application. SBS Modified Bituminous Membrane Physical Properties:
  - .1 Thickness: 3mm.
  - .2 Low Temperature Flexibility: Pass at –20 °C.
  - .3 Reinforcement: 180 g/m<sup>2</sup> Non-woven polyester.
  - .4 Top Face: granulated surface.
  - .5 Under face: sanded.
  - .6 Weight: 40 kg.
  - .7 Acceptable product:
    - .1 System 1: Modified PLUS NP250 as manufactured by Henry.
    - .2 System 2: COLPLY Traffic Cap 460 as manufactured by Soprema.
    - .3 System 3: POWERPLY 3PM as manufactured by Tremco Inc.

### 2.3 ROOF ACCESSORIES

- .1 Termination Bar:
  - .1 3 mm x 25 mm aluminum bar with sealant cup.
  - .2 Fasten bar at 75 mm intervals with compatible fasteners.
- .2 Cant:
  - .1 Fibre cants: equal dimensions to achieve 45 degree angle.

## 3. EXECUTION

### 3.1 GENERAL

- .1 The membrane manufacturer shall visit the site and provide project specific recommendations on installation requirements and details. All work shall be completed in accordance with the membrane manufacturer's project specific recommendations.
- .2 Roofing work shall be performed in accordance with applicable, standard in Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual, except where specified.
- .3 Apply each part of roofing system only when surfaces are clean and dry. Install roofing on a dry deck, free of snow and ice, and oils and solvents. Use only dry materials and apply roofing only during weather that will not introduce moisture into roofing system.

- .4 All adjacent parts of the building shall be protected from damage caused by roofing operations. Any damage caused by this Contract shall be repaired to match the original materials and appearance.
- .5 Locate equipment and materials in areas designated by the Owner and the Consultant.
- .6 Conduct operations so as to leave the roof deck exposed for a minimum period of time. Protect as required to prevent water infiltration or environmental damage to building interior.
- .7 Strictly adhere to manufacturers' recommendations and specifications.
- .8 All aspects of the re-roofing operation shall follow in close sequence.
- .9 The Contractor shall comply with the latest edition and amending regulations of the following documents, and in the case of conflicts between documents, the more stringent rule shall apply:
  - .1 Occupational Health and Safety Act (Revised) Statutes of Ontario 1990.
  - .2 Hazardous Projects Act and the Canada Labour Code, most recent edition.
  - .3 Occupational Health and Safety Regulation for Construction Projects, Revised Statutes of Ontario, Regulation 213-91.
  - .4 The Workers' Compensation Act, Revised Statutes of Ontario, 1990 and Regulations of Board as amended 1990, Toronto.
  - .5 Ontario Building Code Act Chapter 51 and Ontario Regulation 413/90 including amendments to the Regulation 158/93 and 160/93.
  - .6 Ontario Regulation 454 - Fire Code.
- .10 Furnish and maintain all equipment such as stairs, ladders, ramps scaffolds, hoists, runways, derricks, chutes, elevators, etc., as required for proper execution of work including all flood lights and equipment.
- .11 The Roofing Contractor shall provide any guardrails, temporary barricades and barriers as necessary to carry out the work in accordance with the current safety regulations.
- .12 Comply with the requirements of the Workplace Hazardous Materials information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labeling and the provision of material safety data sheets.
- .13 In addition to the requirements of the Occupational Health and Safety Act, and Regulations for Construction Projects, provide temporary safeguards and protection against:

- .1 Accident or injury to any workmen or other persons on the site, adjacent work and property, roads and walks.
- .2 Damage to any part of the work and to any adjoining or adjacent structure, properties, pavements, walks, services, and other similar items by frost, weather, overloading, and any other cause resulting from the execution of the work.
- .14 Make good with material identical to existing and adjoining surfaces any damage resulting from the execution of the work to any part of the work or any buildings, pavements, landscaping or surrounding the site.
- .15 Exposure within the main building of any fumes, water or dust shall be minimized. The Contractor shall coordinate their work in the area of intakes with the Construction Manager and the Building Operations Staff.
- .16 Skilled workers especially trained and experienced in this type of work shall perform all work. If the Contractor chooses to sub-contract any part of this Work, the proposed sub-contractor's qualifications shall meet all applicable parts of this Specification and their name shall be filed with the Owner.

### 3.2 SUBSTRATE PREPARATION

- .1 Where membrane repairs are needed, as directed by the Consultant, remove existing roofing to roof deck.
- .2 Clean the membrane free from oil, dust, dirt, debris, and any other substance that prevent tenacious bond of the new roofing system components.
- .3 Commencing with the work indicates acceptance of the surface conditions by the Contractor.

### 3.3 MEMBRANE INSTALLATION

- .1 Install cants at all horizontal to vertical transitions.
- .2 Install modified bituminous membrane roofing system with ply sheets shingled uniformly to achieve required number of membrane piles throughout. Shingle in direction to shed water.
- .3 Plan the membrane application so that the laps are not superimposed over the laps of the base sheet. Mark a chalk line where first course is to start. Line up with chalk line or to the selvage edge. If roll goes out of line by more than 1/2 inch cut and re-align roll.
- .4 Membrane to be set 40 mil thick uniform bed of adhesive using new notched squeegees. Previously used squeegees are not acceptable.
- .5 Base sheet application: 1/4 inch bleed out of adhesive is required at all sheet edges.
- .6 Cap sheet application: seams are to be heat welded using heat gun achieving a 1/4" bleed out of bitumen.

- .7 Side laps must be a minimum of 3 inches and end laps must be 6 inches minimum. Stagger end joints by a minimum of 300mm.
- .8 Field membrane sheets to extend a minimum of 1.5 inches beyond the top of the cant.

### 3.3 INSTALLATION OF FLASHINGS

- .1 Plan 2-ply membrane flashing application so that the laps are not super-imposed over the laps of the underlying membrane.
- .2 Install membrane flashing with full roll widths perpendicular to the roof deck.
- .3 Install gussets at all inside and outside corners as per manufacturer's written instructions.
- .4 Install base sheet flashing prior to horizontal cap sheet application. Extend membrane 4 inches onto horizontal surface.
- .5 Install cap sheet flashing after application of horizontal surface. Heat weld all cap flashing seams.

### 3.4 INSTALLATION OF ROOF ACCESSORIES

- .1 Remove and reinstate all rooftop accessories (lighting, lightening rod, ladders, piping, cabling, etc.) as required to facilitate the work. Ensure all accessories are reinstated in the same or better condition.

### 3.5 CLEANING

- .1 Clean work in accordance with General Conditions.
- .2 Clean to Consultant's approval, soiled surfaces, spatters and damage caused by contract.
- .3 Check drains and plumbing vents to ensure cleanliness and proper function, remove debris and excess equipment from site.

END OF SECTION 07 52 18

## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 62 00 – Sheet Metal Flashing and Trim

#### 1.0 GENERAL

#### 1.1 SECTION INCLUDES

- .1 Galvanized Steel Sheet Metal
- .2 Prefinished Aluminum Flashing
- .3 Copper Flashing
- .4 Lead Coated Copper Flashing

#### 1.2 RELATED SECTIONS

- .1 Section 01 11 13 – Work Covered by Contract Documents
- .2 Section 04 90 00 – Masonry
- .3 Section 07 55 53 – Cold Applied Elastomeric Protected Membrane Roofing
- .4 Section 07 90 00 – Sealant

#### 1.3 REFERENCES

- .1 ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction
- .2 The Aluminum Association Inc. (AAI)
  - .1 AAI-Aluminum Sheet Metal Work in Building Construction.
  - .2 AAI DAF45 - Designation System for Aluminum Finishes.
- .3 ASTM B209M - Aluminum and Aluminum-Alloy Sheet and Plate
- .4 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 591/A 591 - Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
  - .2 ASTM A 606 - Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
  - .3 ASTM A 653/A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 ASTM A 792/A 792 - Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .5 Canadian Roofing Contractors Association (CRCA).
  - .1 Roofing Specifications Manual.
- .6 CSA B111 - Wire Nails, Spikes and Staples.
- .7 SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - Architectural Sheet Metal Manual.

#### 1.4 SUBMITTALS

- .1 Submit duplicate 300 x 300 mm samples of each type of sheet metal material, colour and finish.

## 1.5 QUALIFICATIONS

- .1 The sheet metal work shall be performed by a recognized specialized fabricator and installer, having at least five (5) years of experience, with skilled mechanics, thoroughly trained and competent in all phases of the work.

## 1.6 WARRANTY

- .1 Contractor shall provide a warranty by the sheet metal installer covering a period of two (2) years for all labour and materials from the date of Substantial Performance of the contract agreeing to furnish sheet metal to repair or replace those that do not comply with performance and other requirements specified in this Section within the specified warranty period.
- .2 Defective work shall include, but is not limited to, premature corrosion, warping, failed anchors, fasteners, and welds, and leakage through seams.

## 2.0 PRODUCTS

### 2.1 PREFINISHED ALUMINUM SHEET

- .1 Pre-finished aluminum sheet, 20 gauge core nominal thickness.
- .2 Finish: factory applied coating to CAN/CGSB-93.1. Colour to be chosen from Manufacturer's standard colour range to match the existing.
- .3 Profile: to match existing profile
- .4 Thickness specified for prefinished aluminum sheet applies to base metal.

### 2.2 GALVANIZED SHEET STEEL

- .1 Zinc coated steel sheet: 24 gauge, commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating.

### 2.3 COPPER FLASHING

- .1 Copper sheet, 24 ounce. Profile to match existing with hemmed edges, drip edges, and starter strips.

### 2.4 LEAD-COATED COPPER SHEET

- .1 Lead-coated copper sheet, 16 ounce. Profile to match existing.

### 2.5 JOINTING

- .1 Linear mating of Cap flashings and Parapet flashings shall be with an "S" lock joint.
- .2 Corner mating shall be completed with a standing seam.

### 2.6 ACCESSORIES

- .1 Starter Strips
  - .1 Same material as sheet metal, minimum 50mm (2") wide with bent to accept cap flashing.
  - .2 Thickness to be minimum of 0.8mm (20ga).
- .2 Touch-up paint
  - .1 As recommended by prefinished material manufacturer.

- .3 Isolation Coating
  - .1 Bituminous Paint to meet CGSB1-GP-108.
- .4 Sealant
  - .1 Refer to Section 07 90 00 – Sealant

2.7 FASTENERS

- .1 All fasteners shall be stainless steel, or include an acceptable corrosion resistant coating.
- .2 Fastener type and spacing to be in accordance with Factory Mutual Loss Prevention Data Sheet 1-49. The following table is a general guideline for fastener types and spacing:

Element	Substrate	Fastener	Min. Embedment	Max. Spacing	
				<8' from outside corner	>8' from outside corner
Starter strip (exterior face)	Wood	No. 10 screw	3/4"	24"	24"
Starter strip (exterior face)	Metal	No. 10 screw	3/8"	24"	24"
Starter strip (exterior face)	Concrete or Masonry	1/4" tapcon screw	1"	24"	24"
Starter strip (interior face)	Wood	No. 10 screw w/ neoprene washer	1"	30"	30"
Starter strip (interior face)	Concrete or Masonry	1/4" tapcon screw	1"	30"	30"
Wood blocking	Wood	No. 12 screw	1-1/4"	2 rows staggered, 12" o/c per row	2 rows staggered, 24" o/c per row
Wood blocking	Concrete or masonry	1/4" tapcon screw	1"	24"	36"
Counter flashing	Masonry	1/4" tapcon screw	1"	36"	36"

2.8 FABRICATION

- .1 Fabricate aluminum flashings and other sheet aluminum work in accordance with Aluminum Association Aluminum Sheet Metal Work in Building Construction.
- .2 Form pieces in 8 foot (2400 mm) maximum lengths. Make allowance for expansion at joints by use of "S-lock" joints one end. "S-lock" to have a 1-inch (25mm) sleeve for mating with free end of consecutive flashing.
- .3 Hem exposed edges on underside 1/2" (12 mm).
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

3.0 EXECUTION

### 3.1 INSTALLATION

- .1 The fastener type to be utilized, and fastener spacing shall be in accordance with Factory Mutual Loss Prevention Data Sheet 1-49.
- .2 Install continuous starter strips where indicated or required to present a true, non-waving, leading edge. Anchor to wood blocking, concrete or masonry substrate to provide rigid, secure installation.
- .3 Install cap flashing by locking into starter strip, pull back tight and screw into blocking. Nail flange of "S-lock" into blocking. Face nailing of joints will not be permitted.
- .4 The second cap flashing will follow same procedure locking into the "S-lock" a minimum of 20mm of previous component.
- .5 Paint the mating surfaces of aluminum and galvanized steel with bituminous or zinc chromate primers. Taping or gasketing with non-absorptive materials or sealants is also acceptable.
- .6 Corners shall be mated with a standing seam joint. Provide a bead of sealant along the inner flange of the seam before crimping tight.
- .7 Use concealed fastenings except where approved before installation.
- .8 Protect material from electrolytic action when dissimilar metals are in contact with one another.

### 3.2 BUTT JOINT INSTALLATION

- .1 Where flashings connect at a 90° angle with a lower flashing adjoining a higher flashing the following will apply:
  - .1 Cut vertical slots into the higher flashing to match the lower flashing profile, bending the bottom flange out,
  - .2 The lower flashing will have vertical flange fabricated and will be installed on the inside of the higher flashing.
  - .3 Provide a sealant joint full length of the mated joint on the lower flashing bedding the top flashing.

### 3.3 CLEANING

- .1 Daily as the work proceeds and on completion, remove all surplus materials and debris resulting from the foregoing work.
- .2 Remove all stains, caulking or other adhesive from all affected surfaces.

END OF SECTION 07 62 00



## **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

### Section 07 90 00 – Sealant

#### 1.0 GENERAL

##### 1.1 SECTION INCLUDES:

- .1 Sealant
- .2 Foam Backer Rod

##### 1.2 GENERAL REQUIREMENTS

- .1 All work necessary for completion of work of this section, including but not limited to setting up of scaffolding, swing-stages, permits, authorization from utilities, etc. The cost associated with these items will not be paid for separately, but will be considered incidental to work of this section.

##### 1.3 REFERENCES.

- .1 ASTM C 510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
- .2 ASTM C 661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
- .3 ASTM C 719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
- .4 ASTM C 794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
- .5 ASTM C 834 Standard Specification for Latex Sealants.
- .6 ASTM C 920 Standard Specification for Elastomeric Joint Sealants.
- .7 ASTM C 1087 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
- .8 ASTM C 1330 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
- .9 ASTM C 1135 Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants
- .10 ASTM C 1184-00 Standard Specification for Structural Silicone Sealants
- .11 ASTM C 1193 Standard Guide for Use of Joint Sealants.
- .12 ASTM C 1247 Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
- .13 ASTM C 1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants.
- .14 ASTM C 1311 Standard Specification for Solvent Release Sealants.
- .15 ASTM C1564-04 Standard Guide for Use of Silicone Sealants for Protective Glazing Systems
- .16 ASTM D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- .17 ASTM D 2203 Standard Test Method for Staining from Sealants.

- .18 ASTM D 2240 Standard Test Method for Rubber Property—Durometer Hardness
- .19 ASTM D 3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- .20 ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Materials

#### 1.4 SUBMITTALS

- .1 Four (4) weeks prior to starting the work, the contractor shall submit the following:
  - .1 List of the materials to be provided under this section.
  - .2 Manufacturer's product data and specifications for each material.
  - .3 Sealant manufacturer's written project recommendations.
- .2 At the Consultant's request, submit samples, including available colours, of the materials to be used on the project.

#### 1.5 QUALITY ASSURANCE

- .1 Perform the work in accordance with the manufacturer's written project recommendations.
- .2 Obtain each type of joint sealant through one source from a single manufacturer.

#### 1.6 QUALIFICATIONS

- .1 The installation of the sealant work shall be performed by a recognized specialized applicator, having at least five (5) years of experience, with skilled mechanics, thoroughly trained and competent in all phases of the work.

#### 1.7 MOCK-UP

- .1 Construct mock-ups two (2) weeks prior to commencement of the work to demonstrate all of the joints encountered in this project.
- .2 The mock-ups shall be 1 m in length for each type of sealant and substrate.
- .3 The mock-ups shall demonstrate the surface preparation prior to the sealant installation and the location, size, shape, colour, depth of joints, and adhesion and cohesion, complete with back-up material, primer, and new sealant.
- .4 Upon receipt of written confirmation from the Consultant, the mock-up may remain as part of the finished work.
- .5 The approved mock-up shall be the standard to which all work shall be performed.
- .6 The mock-up shall be performed prior to the pre-installation conference.

#### 1.8 PRE-INSTALLATION CONFERENCE

- .1 Convene a pre-installation conference at least one (1) week prior to commencing the work of this section.
- .2 All parties directly affecting work of this section must be in attendance.
- .3 All submittals, mock-ups and procedures will be reviewed at this meeting.

#### 1.9 DELIVERY, STORAGE AND PROTECTION

- .1 Deliver all materials to the job-site in their original unopened containers with labels indicating manufacturer, product name and designation, colour, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
- .2 Store all materials in strict accordance with the manufacturer's recommendations.
- .3 Keep the materials dry and protected from the weather, freezing and contamination.
- .4 Ensure that the labels and seals on all materials are intact upon delivery.
- .5 Remove rejected or contaminated materials from the site.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Labelling and provision of MSDS sheets shall be acceptable to Labour Canada.
- .2 Ensure that all materials, containers, rags, etc. are disposed of in accordance with the local Waste Management Plan and hazardous material disposal regulations and requirements.

#### 1.11 ALTERNATIVES

- .1 Alternatives to manufacturer's brands or supply sources of materials will not be accepted.

#### 1.12 WARRANTY

- .1 Contractor shall provide a warranty by the sealant manufacturer covering a period of five (5) years for all labour and materials from the date of Substantial Performance of the contract agreeing to furnish sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within the specified warranty period.
- .2 Defective work shall include, but is not limited to, joint leakage, cracking, crumbling, melting, running, loss of adhesion or loss of cohesion, and substrate staining.
- .3 Sealants to be Validated by SWRI (Sealant Weatherproofing Restoration Institute).

#### 1.13 CONSULTANT REVIEW

- .1 The Contractor shall provide access, permit inspection, correct any defects and obtain written approval to proceed from the Consultant prior to commencing with each phase of work.
- .2 The Consultant's general review during construction are undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.
- .3 The Contractor shall provide a third life line on each swing-stage at all times to facilitate the Consultant's review of the work.
- .4 Should additional work and/or visits by the Consultant be required because of the Contractor's failure to perform in accordance with the contract documents, or if additional design or drafting time is required by the Consultant to provide/review corrective measures caused by the Contractor's failure to perform in accordance with the contract documents, the Contractor shall reimburse the Consultant at the rate of direct personnel expense plus 150% overhead plus travel, equipment and material costs plus H.S.T. where applicable.

#### 1.14 ANTICIPATED FIELD TESTING PROGRAM

- .1 Material and adhesion tests shall be conducted at the discretion of the Consultant on a random basis to show that properties are appropriate to the particular sealant and proper bond is achieved.
- .2 Extent of testing shall be as follows:
  - .1 Ten (10) tests for the first 1 000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.
  - .2 One (1) test for each 1 000 feet (300 m) of joint length therefore or one test per each floor per elevation.
- .3 The Contractor shall repair all test areas as part of the work in accordance with this section.
- .4 All sealant installation failing material and adhesion tests shall be rectified in accordance with manufacturer and Consultant approved methods. Rectified areas will be retested until results confirm compliance with the manufacturer's written requirements.

## 2.0 PRODUCTS

### 2.1 SEALANT

- .1 Porous Substrates (Clay Brick, Concrete, Stone, etc.) ~~5-year warranty~~
  - .1 Tremsil 400 by Tremco Ltd. or Dow Corning Contractors Weatherproofing Sealant (CWS) or Dow Corning Contractors Concrete Sealant (CCS)
  - .2 Dow Corning 790 Silicone Building Sealant
  - .3 Dow Corning 756 SMS; Silicone Building Sealant manufactured by Dow Corning Corporation.
  - .4 SilPruf NB SCS 9000 manufactured by GE Silicones.
  - .5 Spectrem 3 or 4 manufactured by Tremco Ltd.
  - .6 Sonolastic 150VLM manufactured by Degussa Building Systems
- .2 Non-porous Substrates (Glass, Metal, etc.)
  - .1 Dow Corning 791 manufactured by Dow Corning Corporation.
  - .2 Dow Corning 795 manufactured by Dow Corning Corporation.
  - .3 SilPruf manufactured by GE Silicones.
  - .4 Spectrem 2 manufactured by Tremco Ltd.
  - .5 Spectrem 1 manufactured by Tremco Ltd.
- .3 Porous Substrate/Metal Substrate
  - .1 Dow Corning 790 Silicone Building Sealant or Dow Corning 756 SMS Silicone Building Sealant manufactured by Dow Corning Corporation.
  - .2 SilPruf NB SCS 9000 manufactured by GE Silicones.
  - .3 Spectrum 3 or 4 manufactured by Tremco Ltd.
- .4 Interior – Applicable for Window Perimeter
  - .1 Tremflex 834 manufactured by Tremco Ltd
  - .2 Sonolac manufactured by Degussa Building Systems.

- .5 The colour of the sealant to match existing as approved by the Owner. Custom colour may be required if the manufacturer's range of standard colours is not suitable.
- .6 The Contractor shall obtain written confirmation of the sealant suitability for this project. A copy of this confirmation shall be forwarded to the Consultant prior to commencing with the work of this section.

## 2.2 PRIMERS

- .1 Primer shall be as specified by the sealant manufacturer.

## 2.3 JOINT BACKING

### .1 Butt Joint and Bridge Joint Applications

- .1 Cylindrical Sealant Backing, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Material shall be of type that will not adhere to the specified sealant:
  - .1 Closed-cell material (i.e. polyethylene) with a surface skin. Do not puncture backer; rod may cause bubbling in sealant.
  - .2 Bi-cellular material with a surface skin.
  - .3 Open-cell material OR Open cell foam backer rod shall not be used on this project.
- .2 Where the joint size cannot accommodate foam rod, polyethylene tape or other joint backing material recommended by sealant manufacturer shall be used.

### .2 Fillet Joint Applications

- .1 Bond breaker tape, polyethylene tape or other plastic tape recommended by the sealant manufacturer shall be used to prevent adhesion to the specified sealant or to the back of joint.

## 2.4 CLEANING AGENT

- .1 The cleaning material for the surfaces to receive the sealant shall be as recommended by the manufacturer of the sealant.

## 2.5 MASKING TAPE

- .1 Non-staining, non-absorbent material compatible with joint sealant and surface adjacent to joints.

## 3.0 EXECUTION

### 3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the work of this section.
- .2 Commencing with the installation means acceptance of the existing substrates by the Contractor.
- .3 Examine the areas and conditions under which the work will be performed. Review the planned operating procedures with the Consultant. Do not proceed with work until any unsatisfactory conditions are corrected in a manner acceptable to both the Owner and the Consultant.
- .4 Verify that the specified environmental conditions exist before commencing with the work.
- .5 The Contractor shall arrange for the sealant Manufacturer's representative to visit the site and review the surface preparation and installation procedures at the start of the work.

### 3.2 PROTECTION

- .1 The Contractor is responsible for maintaining the work weather tight during the course of the project. At the end of each work day or when stoppage occurs, provide necessary protection to prevent water penetration through the exterior walls.
- .2 Seal and protect all openings, doors, windows and adjacent areas to minimize the potential for damage and the spread of dust, water or other materials into the building or adjacent sidewalks and properties.
- .3 Protect adjacent finished materials from marking or damage during the work.
- .4 Protect completed sealant installation during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes such that sealant is without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, such sealant shall be rectified immediately.

### 3.3 SURFACE PREPARATION

- .1 Consult and follow the sealant manufacturer's project recommendations.
- .2 Remove the existing sealant around the penetrations without causing damage to the substrates.
- .3 Remove dust, paint, loose mortar and other foreign matter, and dry joint surfaces.
- .4 Where necessary to protect the adjacent surfaces, mask by suitable means prior to priming and sealant installation.
- .5 Report in writing to the Consultant, any conditions which may be detrimental to the proper performance of the work. Proceeding with the work shall be taken as acceptance of the existing surfaces and conditions.
- .6 The joints shall be clean, dry and free of frost and foreign matter prior to surface application.
- .7 Butt and Bridge Joint Applications
  - .1 Examine the joint sizes and correct as required to allow for the anticipated movement and to achieve proper width / depth ratio in accordance with the manufacturer's recommendations for the specified sealant unless indicated differently on the drawings, or by the Consultant.
  - .2 Should joint width correction be required, ensure that the correction is distributed appropriately to each side of joint.
- .8 Fillet Joint Applications
  - .1 Remove oil, grease and other coatings from non-ferrous metals with an approved cleaning solvent or abrasive technique. Obtain approval from the Consultant prior to commencing.

### 3.4 PRIMING

- .1 Prime all substrates as directed by the sealant manufacturer's recommendations.
- .2 Prime sides of the joint using the two-cloth method in accordance with the manufacturer's directions, immediately prior to sealant installation.
- .3 Primers that require application by the wipe of a clean, soft cloth, shall be poured onto the cloth. Do not dip the cloth into the primer container.

- .4 Prime only as much area as can be sealed in the same working day.

### 3.5 INSTALLATION OF THE BACK-UP MATERIAL

#### .1 Cylindrical Sealant Backing:

- .1 Install the backer rod without stretching, twisting, braiding or puncturing the outer skin. Do not leave gaps between ends of sealant backings.
- .2 Use an approved installation tool that is blunt surfaced and is designed accurately to place the backer rod.
- .3 Using the approved tool, smoothly and uniformly place the backer rod to the recommended joint depth and rod compression.
- .4 The minimum compression of the foam backer rod is twenty-five (25) percent. Vary backer rod size as required to achieve specified compression.

#### .2 Bond Breaker Tape:

- .1 Install bond breaker tape without stretching, twisting or puncturing the tape.
- .2 Use an approved installation tool that is blunt surfaced and is designed accurately to place tape within the joint.
- .3 Width of bond breaker tape shall fit exactly the width of the joint.
- .4 Install tape at the back of the joint.
- .5 Do not leave gaps between ends of bond breaker tape.

#### .3 Three-sided adhesion is not permitted.

- .4 Foam backer rod shall only be installed in areas that can be sealed in the same working day.

### 3.6 APPLICATION

- .1 The Contractor shall have a trained representative on site at all times who is responsible for all sealant applications.
- .2 Perform all work in strict accordance with the manufacturer's printed instructions. The Contractor shall provide the Consultant a copy of these instructions prior to commencing with the injection and sealing operations.
- .3 Mix multi-component sealant such that air pocket formation is minimized in accordance with the manufacturer's recommendation.
- .4 The sealant must be applied continuously to ensure that all voids and joints are completely filled.
- .5 Tool the sealant with light pressure immediately after application to ensure positive and complete contact of the sealant to the interface. Only tooling agents that are approved in writing by the sealant manufacturer and that do not discolour sealants or adjacent surfaces shall be used.
- .6 Neatly tool the surface to form a slight concave profile. The surface of the sealant shall be smooth, free from ridges, wrinkles, air pockets and embedded impurities.

### 3.7 TWO-STAGE SEALANT JOINT

- .1 A two-stage sealant bead consists of two sealant beads separated by a drained air space with each sealant bead having its own appropriate joint backing material.

- .2 The interior sealant bead shall be allowed to fully cure prior to the installation of the exterior bead. Sealant cut tests to confirm adhesive properties must be completed by the Consultant and repaired by the Contractor prior to the installation of the exterior bead. Obtain written confirmation from the Consultant prior to proceeding with the installation of the exterior bead.
- .3 A minimum of 25 mm must be maintained between the exterior face of the interior sealant bead and the back of the joint backing material for the exterior bead.
- .4 The Contractor is to ensure that the installation of a primer or surface preparation procedures for the interior sealant bead do not inhibit the adhesion of the exterior sealant bead.
- .5 At the intersection of horizontal and vertical sealant joints, return the horizontal interior sealant bead to interface with the exterior sealant bead closing the air space between sealant beads.
- .6 Install gap in the exterior vertical sealant joint at all intersections of horizontal and vertical sealant joints as per the details.

### 3.8 ROUT AND SEAL REPAIRS

- .1 Grind sides of crack to a minimum width of 6mm and depth of 6mm (1/4 inch).
- .2 Apply bond breaker tape inside the joint.
- .3 Fill the joint with sealant. Tool sealant following application.

### 3.9 CLEAN UP

- .1 Clean the adjacent surfaces immediately and leave the work area neat and clean. All excess (sealant and primer) and droppings shall be removed using the recommended cleaners as the work progresses.
- .2 All masking shall be removed immediately after tooling the joints. Sealant affected by the masking removal shall be retooled to achieve proper joint configuration.

END OF SECTION 07 90 00





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## **MECHANICAL SPECIFICATIONS**

FOR

**CITY OF TORONTO**

**ANIMAL SERVICES**

1300 SHEPPARD AVE W

TO

**CITY OF TORONTO**

DATED

**APRIL 08, 2024**

**ISSUED FOR TENDER**

Contact Person: Peera Butrsingkorn  
Phone: 416-598-2920 Ext. 359  
Email: [peera@mcw.com](mailto:peera@mcw.com)

MCW Project No. 22241H

**PART 1 - GENERAL**

**1.01 GENERAL REQUIREMENTS**

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.

**1.02 APPLICATION**

- .1 This Section applies to and is a part of all Sections of Divisions 20, 21, 22, 23 and 25.

**1.03 PERFORMANCE**

- .1 Perform all mechanical work detailed in the Documents to provide complete and fully functional mechanical systems to the satisfaction of the Consultant.
- .2 The most rigorous of these Specifications and the Base Building Standards shall form the basis for acceptance of the Work.

**1.04 SCHEDULE**

- .1 Comply with the General Contractor's construction schedule. Include the cost of premium time in the Bid Price for work provided during nights, weekends or other times outside normal working hours, necessary to maintain all mechanical services in operation and to meet the project schedule.
- .2 Where project phasing is required, refer to the phasing plan(s) included with the Documents. Include all costs associated with completing the Work in sequential phases as outlined in the phasing plan(s).

**1.05 DEFINITIONS**

- .1 "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.
- .2 Wherever the term "This Sub-Contractor" is used in the Division 20, 21, 22, 23 and 25 Drawings and Specifications, it means the firm having a subcontract with the "Contractor" to perform, supervise and co-ordinate all work of this Division.
- .3 Wherever the term "install" (and tenses of "install") is used in the Division 20, 21, 22, 23 and 25 Drawings and Specifications, it means install and connect complete.
- .4 Wherever the term "supply" is used in the Division 20, 21, 22, 23 and 25 Drawings and Specifications, it means supply only.
- .5 Wherever the term "Provide" or "Provision of" are used in relationship to equipment and other materials specified for the Work of Division 20, 21, 22, 23 and 25 it means "Supply, Install and Connect". Wherever the terms "Provide" or "Provision of" are used in connection with services such as testing, start-up and commissioning for any part of the Work of Division 20, 21, 22, 23 and 25, it means procure, supervise, take responsibility and pay for these services.
- .6 Whenever "Drawings" or "Specifications" or "Drawings and Specifications" are referred to herein, it means "the Contract Documents".

- .7 Wherever the terms "Authorities" or "Authorities Having Jurisdiction" or "AHJs" are used in the Division 20, 21, 22, 23 and 25, Drawings and Specifications, it shall mean any and all current laws and/or by-laws of any federal, provincial or local authorized agencies having jurisdiction over the sum total or parts of the Work. The following is indicative, but not restricted to, the Authorities Having Jurisdiction including Municipal Planning and Building Department, Municipal Fire Department, The Construction Safety Act, Municipal Public Works Department, Federal and/or Provincial Fire Marshall, the Ontario Electrical Safety Code, the Technical Standards and Safety Authority, and the Ontario Building Code. There may be more than one Authority Having Jurisdiction.
- .8 Wherever the term "Work" is used in the Division 20, 21, 22, 23, and 25 Drawings and Specifications, it means all equipment, permits, materials and labour to provide a complete electrical installation as required and detailed in the Drawings and Specifications.
- .9 Wherever the term "Acceptable" is used in the Division 20, 21, 22, 23, and 25 Drawings and Specifications it means acceptable to the Consultant.

**1.06 BUILDING CODES AND CONSTRUCTION STANDARDS:**

- .1 Conform to requirements of the Ontario Building Code, City of Toronto and the Authorities Having Jurisdiction (AHJs); note that there may be more than one AHJ.
- .2 Applicable Codes, Standards and Bylaws shall be strictly adhered to. Obtain necessary permits, approvals and inspections from the Authorities Having Jurisdiction (AHJs).
- .3 Permits and Fees required by the Authorities Having Jurisdiction (AHJs) for the Mechanical Work shall be obtained and paid for by the Mechanical Trades; include all applicable taxes. Arrange for the inspection of work by the AHJs over the Mechanical Work. All changes and alterations required by the AHJs shall be carried out promptly and without additional charge.

**1.07 WORK INCLUDED**

- .1 Sections of Division 20, 21, 22, 23 and 25 are not intended to delegate functions nor to delegate work and supply to any specific trade and the Work shall include all labour, materials, equipment and tools required for a complete and working installation as described, but not necessarily limited to items in the following Sections:

Section 20 05 10	Mechanical General Requirements
Section 20 10 10	Basic Materials and Methods
Section 20 20 10	Insulation
Section 21 05 10	Fire Protection
Section 22 05 10	Plumbing and Drainage
Section 23 20 10	HVAC Piping and Pumps
Section 23 30 10	HVAC Air Distribution
Section 23 58 10	Electric Heating
Section 23 83 10	Glycol Snow Melting Systems
Section 25 05 10	Building Automation System & Controls

- .2 Review mechanical, electrical, structural and architectural drawings to become familiar with installation requirements of the Work. Properly plan, coordinate and establish exact locations and routing of services with affected Trades prior to installation such that they clear each other as well as any obstructions. Generally, piping requiring uniform pitch is given right of way, with other services located and arranged to suit.
- .3 Comply with Manufacturer's installation requirements and guidelines for all specified equipment. Install equipment in accordance with the Drawing details and the requirements of the Authorities Having Jurisdiction (AHJs). Provide means of isolating all new and relocated equipment. Provide proper supports for all new and relocated equipment and connecting services.
- .4 Review with Consultant and coordinate with respective Trades to ensure equipment is fully accessible for maintenance; failure to do so will not be grounds for additional costs.
- .5 Conform to Landlord/Owner's design criteria and construction manual and tenant lease agreement.
  - .1 All existing mechanical equipment (example: VAV boxes, dampers, heat pumps, valves, and similar equipment) to be relocated out of new drywall ceiling areas.
  - .2 Repair and clean all existing equipment to be re-used as part of the Work.
- .6 Provide sleeves for all new piping passing through floor and roof slabs, beams, concrete walls and slab to slab partitions.
- .7 Seal service penetrations so that they are air-tight around all ductwork and piping penetrations through partitions, baffles above ceilings, and through floors that are not fire rated.
- .8 Obtain Consultant approval of all air terminal, thermostat, and access door locations must be obtained prior to installation.
- .9 Generally the Project Specific Scope of Work is as follows:
  - .1 Remove existing refrigerant charge from exiting VRF systems and compare with original refrigerant charge;
  - .2 Remove existing refrigerant dryer cores; cores are not to be replaced;
  - .3 Test refrigeration system piping for leaks and repair any leaks found;
  - .4 Replace 2 existing defective VRF cassette units identified on the Drawings with new, current model units as noted on the drawings;
  - .5 Include for removal of 4 VRF existing units above kennel areas and replace with new horizontal; discharge units in service corridor (placement of new units shall ensure units can be serviced/maintained without going into kennel spaces);
  - .6 Recharge refrigerant circuits with new refrigerant gas; existing refrigerant gas is not to be reintroduced back into the system.
  - .7 Provide supplementary electric heat in the form of wallfin elements, wall mounted fan heaters, ceiling mounted fan heaters and duct mounted reheat elements as noted won the Drawings.
  - .8 Coordinate with Electrical Trades for the provision of power and control wiring associated with new and modified equipment.

- .9 Demolish existing glycol snow melting system tubing as noted on the drawings and replace with new.
- .10 Replace existing snow melt system distribution heater complete with new circuit isolation and balancing valves, and control valve.
- .11 Integrate all new and existing equipment modified as part of the scope of the Project to the existing Building Automation System (BAS).

#### 1.08 LANDLORD/OWNER'S REQUIREMENTS

- .1 Comply with Landlord/Owner's requirements for system planned interruption to existing services. Interruption of service must occur at the times and for the duration stipulated by the Landlord/Owner. Carry out all preparatory work, measurements, and similar, without interruptions of existing services.
- .2 Arrange with Landlord/Owner for necessary shutdowns of all systems and include all overtime costs in the Bid Price for tie-ins and work within other tenant spaces to be completed on weekends and at other times suitable to Landlord/Owner and other occupants.
- .3 Premium time costs shall be included for Mechanical Work required to be performed outside of normal working hours.
- .4 All Work is subject to review and/or approval of the Landlord/Owner, and Building Manager for conformance to Base Building Standards, in addition to the reviews completed by the Consultant and the Authorities Having Jurisdiction (AHJs).

#### 1.09 PERMITS, FEES AND INSPECTIONS

- .1 Apply for, obtain, and pay for all permits, licenses, inspections, examinations and fees required for Work of Division the Division 20, 21, 22, 23, and 25.
- .2 If the municipality is structured as a "single permit jurisdiction", the Contractor will apply, pay for and obtain the municipal building permit. In this case, the Mechanical Trade Contractor has no financial obligation for permit application except for permits not covered in the "single permit".
- .3 Arrange for inspection of all Work by the Authorities having jurisdiction over the Work. On completion of the Work, present to the Consultant the final unconditional certificate of approval of the inspecting Authorities.
- .4 Comply with the requirements of the latest edition of the applicable CSA standards, the requirements of the Authorities, Federal, Provincial and Municipal Codes, the applicable standards of the Underwriters' Association and all other Authorities having jurisdiction. These codes and regulations constitute an integral part of these specifications.
- .5 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.
- .6 Before starting any work, submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Consultant immediately of such changes. Prepare and furnish any additional drawings, details or information as may be required.

#### 1.10 CONTRACT DRAWINGS

- .1 The Drawings for Mechanical Work are performance drawings, diagrammatic, intended to convey the scope of work and indicate general arrangement and approximate location of equipment, ancillaries and distribution piping and ductwork. The Drawings do not intend to show architectural and structural details.
- .2 Do not scale Drawings. Obtain information involving accurate dimensions from dimensions shown on Architectural and Structural drawings, and by site measurement.
- .3 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (conduits around beams, columns, etc.)
- .4 Alter, at no additional cost, the locations of materials and/or equipment as directed that do not necessitate additional material.
- .5 Install ceiling mounted components (e.g., light fixtures, speakers, heat or smoke detectors) in accordance with reflected ceiling drawings.
- .6 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to Architectural and Structural details.

**1.11 EXISTING CONDITIONS:**

- .1 Existing site conditions affecting the work of this trade shall be reviewed prior to Bid submission. Failure to do so shall not relieve Mechanical Trades of full contract responsibility. Include for any alternate routing of new or rerouting of existing services to accommodate all site conditions in the Bid Price. Determine exact dimensions and other restrictive conditions on site, not from drawings.
- .2 Prior to submitting Bid, the Mechanical Trades shall report all discrepancies to the Consultant and verify the locations of all existing services that are to be extended and the routing of new services. Report any ambiguities, discrepancies, departures from building by-laws and/or from good practice. Additional payments will not be made for extra labour or material necessary due to location or nature of beams, joists, walls, furred ceilings, or finishes with which Contractor should be familiar.
- .3 Problems with operation and servicing of existing equipment due to installation of new ductwork, sprinkler and plumbing piping will result in Mechanical Trades having to relocate new ductwork, sprinkler and plumbing lines at their own cost.
- .4 Reuse existing materials and equipment wherever possible. Provide new materials and equipment as required to ensure a complete installation.

**1.12 SITE SUPERINTENDENCE**

- .1 Maintain at the job site, at all times, qualified personnel and supporting staff, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

**1.13 DEMOLITION**

- .1 Demolition work will be executed in accordance with the latest edition of:
  - .1 CAN/CSA-S350-M1980 Code of Practice for Safety in Demolition of Structures;
  - .2 Occupational Health & Safety Act;
  - .3 Ontario Building Code;
  - .4 Ontario Fire Code.

- .2 All existing equipment, materials and associated controls removed under this contract shall be packaged and turned-over to the Landlord/Owner at their direction.
- .3 Use only those existing entrances and stairs designated by the Landlord/Owner for access to the egress from the existing buildings and various floors when work of this contract is to be carried out. No traffic through other areas of the building will be permitted without the prior consent of the Landlord/Owner.
- .4 Only elevators, dumbwaiters, conveyors or escalators assigned for Mechanical Trade's use may be used for moving personnel and material within building. Protect walls of passenger elevators to approval of Landlord/Owner prior to use. Accept liability for damage, safety of equipment and overloading of existing equipment.
- .5 The drawings indicate the approximate locations of services as far as these are known. Should any mechanical or electrical service line be broken or disrupted by operations specified under this contract, repair service lines, and make good all damage due to the disruption or break, at no expense to the Landlord/Owner. Notify the Landlord/Owner Immediately whenever any service line is broken or damaged.
- .6 The drawings indicate the approximate locations of services as far as these are known. Immediately advise Consultant in writing when unknown services are encountered.
- .7 Disconnect, capping and make-safe all gas, water, sewer, storm and other services affected by the Work being demolished.
- .8 Include in the Bid Price for all shipping and placement in a designated on-site storage location.

#### 1.14 PROTECTION OF WORK

- .1 Mechanical Trades shall be entirely financially responsible for all damage to property or adjacent property, arising of the Work of this Contractor, whether caused by themselves or any persons they have engaged in their Work.
- .2 Mechanical Trades shall be responsible to ensure that their employees and Sub-trades use only safe practices and conditions, observe all safety regulations, security regulations and fire safety rules.

#### 1.15 CHANGES TO THE WORK

- .1 Before proceeding with any changes, submit for review and approval by the Consultant; approval shall come in the form of a Change Order signed by the Landlord/Owner.
- .2 Change quotations shall be submitted complete with an itemized cost breakdown of all materials, equipment and labour costs associated with each submission for additional or deleted work. Failure to provide will result in rejection.
- .3 All Mechanical Change Notices shall be priced using mechanical labour unit costs in accordance with Mechanical Contractors Association of America (MCAA) Labor Estimating Manual;
- .4 It is understood that each change may have a variety of non-typical or abnormal factors that will require adjustments. Under no circumstances shall the cumulative total of additional factors exceed 20% of the hours established using Base Labour units.
- .5 Provide copies of the Allpriser published list prices used to estimate material and equipment costs, less discount of 20%.
- .6 The mark-up for overhead and profit shall be limited to and be calculated as follows;

- .1 Work carried out by the Trade Contractor or Trade Subcontractor: 10% overhead and profit combined.
- .2 Trade Contractor's overhead and profit on Trade Subcontractor's work: 5% overhead and profit combined.
- .3 The cumulative total percentage for overhead and profit charged by the Trade Contractor, Trade Subcontractor and others shall not exceed 20% of the cumulative total value of such change in the work, net of overhead and profit.

**1.16 EQUIPMENT AND MATERIALS**

- .1 Use only new materials, capitals and code approved in accordance with all laws, regulations and Authorities Having Jurisdiction (AHJs).
- .2 All material and equipment shall meet or exceed base building standards and have Landlord/Owner's approval before ordering.

**1.17 SHOP DRAWINGS**

- .1 Submit shop drawings, unless otherwise specified, for each major item of equipment such as plumbing fixtures, pumps, air handling units, radiation, coils and special systems.
- .2 Shop drawings shall be complete with contractors reviewed stamp. Allow five (5) days for Mechanical Consultant review.
- .3 Resubmit shop drawings returned for correction until 'reviewed' or 'reviewed as noted' status has been achieved.

**1.18 EQUIPMENT SUBSTITUTIONS**

- .1 Base Bid Price on equipment specified. Show alternative equipment and itemized cost savings with Bid submission.
- .2 Equipment substitutions proposed following award of contract will not be considered without written explanation.
- .3 The quality and performance characteristics of substituted product shall be equivalent in all respects to the specified product. Substitution of any product other than specified must assure no deviation below the stated capacities, air flow rate, heat transfer rate, filtration efficiency and air mixing quality. Power requirements must not be exceeded and, where specifically defined, sound power levels must not be exceeded. Equipment weight and space requirements shall not be in excess of those allowed in the design. Applications for "equal" or "alternate" must address these factors.
- .4 All substitute products shall be reviewed by the Consultants; do not proceed with substituted equipment without Consultant's written authorization.
- .5 Any additional costs incurred by affected Trades for substituted equipment shall be borne by the Mechanical Trades without additional compensation.

**1.19 PATENTS**

- .1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights.



- .2 Save the Owner and Consultant harmless of loss, or annoyance, on account of suit, or claims of any kind for violation or infringement of any letters, patent or patent rights by the Mechanical Trades by reason of the use by them of any part, machine, manufacture or composition of matter of the Work, in violation or infringement or such letters, patent or rights.

**1.20 RIGHTS RESERVED**

- .1 Rights are reserved to furnish any additional detail drawings, which in the judgement of the Consultant may be necessary to clarify the Work, and such drawings shall form a part of this Contract.

**1.21 EQUIPMENT NAMEPLATES**

- .1 Provide apparatus with proper nameplates affixed thereto, showing the size, name of equipment, serial number and all information usually provided, which also includes voltage, cycle, phase, horsepower of motors and the name and address of the manufacturer.

**1.22 EXPEDITING AND DELIVERY**

- .1 Continuously check and expedite delivery of equipment and materials, if necessary, inspect at the source of manufacture.
- .2 Continuously check and expedite the flow of necessary information to and from all parties involved.
- .3 Immediately inform the Consultant in case information is required from him.
- .4 Provide delivery records updated monthly.

**1.23 OWNER'S EQUIPMENT**

- .1 Where the drawings indicated equipment to be furnished by the Owner, or by Trades outside of this Contract, provide mechanical rough-in for each unit pursuant to its shop drawings, and make final connections and other mechanical facilities for a complete installation.

**1.24 CLEAN-UP**

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work. Clean the Work area on a daily basis
- .2 After completion of the Work, remove rubbish and debris from the site, arrange and pay for disposal of all waste materials. Repair any damage caused.
- .3 Leave systems operating and premises in good order working. Clean areas to acceptance of the Landlord/Owner.

**1.25 COORDINATION DRAWINGS**

- .1 Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure, and all inserts, equipment bases, and supports, and relate these to suitable grid lines and elevation datum.
- .2 When requested, provide weights of major items of equipment.
- .3 Prepare interference and co-ordination drawings for all areas where the work of this division could conflict with and/or obstruct the work of other trades and/or other sections of this division. Submit drawings for review by the Consultant.

**1.26 CONTRACTOR'S AS-BUILT DRAWINGS**

- .1 Record accurately installed (as-built) Mechanical Work as “red-line” mark-ups on white prints. Mechanical Trade’s “red-line” as-built drawings shall be transferred to an editable AutoCAD format “as-built drawing” by the Mechanical Trade Contractor. Submit both copies for review. Keep one up-to-date set on site.

#### 1.27 OPERATING AND MAINTENANCE (O&M) MANUALS

- .1 O&M Manuals shall be submitted to the Consultant for review.
- .2 O&M Manuals shall include Reviewed shop drawings, Testing, Adjusting and Balancing (TAB) Reports, equipment data sheets, written warranty, operating instructions and maintenance procedures.
- .3 Provide piping pressure tests (fire protection, domestic water, HVAC piping) indicating system tested, pressure held, time of test and date, and certified by the Consultant.
- .4 O&M Manuals shall be separated with dividers in appropriate sections.
- .5 Make all corrections requested by the Consultant and resubmit for review.

#### 1.28 WARRANTY

- .1 Submit written warranty to Landlord/Owner covering remedy of defects in work at completion of work. Submit similar written warranty for two (2) years from date of Substantial Performance for any part of work accepted by Landlord/Owner.
- .2 Repair and/or replace any such defects which appear in work within warranty period without additional expense to owner; ordinary wear and tear and willful damage by, or carelessness of owner’s staff or agents excepted. Where such defects occur, be responsible for costs incurred in making defective work good, includes repair or replacement of building finishes, other materials, or damage to other equipment caused by such defects, or by subsequent replacement or repairs.
- .3 During the one year warranty period, the Mechanical Trades shall respond to the site on a 24 hour “call out” period whereby at any time of day or night appropriate Trades shall attend to all faults and complaints, remedy all defects, replace all malfunctioning items and maintain the complete installation in a clean and tidy condition to the satisfaction of the Consultant.

#### 1.29 TEMPORARY TRIAL USAGE AND TESTING

- .1 The Landlord/Owner has the privilege of trial usage of Mechanical Systems, or parts thereof, for the purpose of testing.
- .2 Assist in trial usage over a length of time as deemed reasonable by the Consultant at no extra cost, and do not waive any responsibility because of trial usage.
- .3 Temporary trial usage and testing shall not be construed as “beneficial use” when making an application for Substantial Completion of the Work.

#### 1.30 CONSULTANT INSPECTIONS OF THE WORK AND CONTRACT CLOSE-OUT

- .1 Consultant’s Inspection(s) are imperative. Prior to installation of all ceilings, this Contractor shall contact the Consultant, Mr. Mark Caminiti (tel: 416-598-2920 or email; mcaminiti@mcw.com) and the Landlord/Owner’s Representative to arrange for an Inspection.
- .2 Should mechanical work be covered up at the time of an Inspection, including services enclosed behind finished drywall, above finished ceilings, or concealed by finished millwork, the Mechanical Trades shall arrange for the Work to be exposed to complete the Inspection.

- .3 The Mechanical Work will not be considered Substantially Performed until:
  - .1 All deficiencies that will prevent the intended use of the building systems have been identified and corrected;
  - .2 Completion of air and water balancing, even if undertaken by separate contract from the Mechanical Trades;
  - .3 Operating and Maintenance (O&M) manuals have been submitted;
  - .4 Landlord/Owner training has been completed;
  - .5 Commissioning work has been completed.
- .4 When the Final Inspection request is made to certify Total Completion, ensure all of the following conditions have been satisfied:
  - .1 all deficiencies must be corrected;
  - .2 systems shall be ready for operation;
  - .3 all commissioning work must be completed;
  - .4 the final commissioning report has been submitted and accepted;
  - .5 operating and maintenance (O&M) Manuals have been submitted and accepted;
  - .6 all tags, charts and nameplates completed;
  - .7 all fixtures and equipment cleaned;
  - .8 all "attic stock" and spare parts have been provided;
  - .9 record drawings have been completed and submitted;
  - .10 control systems are complete and operational;
  - .11 the Landlord/Owner's staff instructed in all phases of the system operation.
- .5 On Total Completion of the Work, present to the Landlord/Owner a final unconditional certificate of approval from the Authorities Having Jurisdiction (AHJs).

## PART 2 - PRODUCTS

2.01 NIL

## PART 3 - EXECUTION

### 3.01 TESTING, ADJUSTING AND BALANCING (TAB)

- .1 Prior to operating any existing or new equipment during any stage of construction, approval from the Landlord/Owner and Consultant must be received in writing.
- .2 Testing Adjusting and Balancing (TAB) work shall be performed by an independent company normally employed in this field.
- .3 The Mechanical Trades shall carry the cost of Testing Adjusting and Balancing (TAB) Trades in their Bid Price.

- .4 Testing Adjusting and Balancing (TAB) work shall be performed in accordance with NEBB, AABC, ASHRAE and SMACNA standards.
- .5 Include all necessary services for the successful completion of point-to-point verification of devices, and performance verification of individual devices and composite systems as part of the project Building Automation System (BAS) verification work, and the project commissioning requirements.
- .6 Provide assistance to the Consultant for on-site spot verification of results recorded in the air and water balancing reports.
- .7 Fan sheaves, belts and pulleys shall be adjusted or replaced as required to obtain design air quantities. Coordinate this Work with Landlord/Owner.
- .8 Submit TAB Reports to each: Landlord/Owner, Tenant, and Consultants.
- .9 Air Balance Report:
  - .1 Air balancing shall be performed by an independent company normally employed in this field. All air quantities to be balanced with a tolerance of +/-5%. Issue a report and certificate covering the following:
    - .2 Specified and actual fan total static pressures with breakdown showing inlet and discharge pressures.
    - .3 Nameplate and actual motor loading in amperes at actual voltage and installed overload heater size and manufacturer.
    - .4 Instruct Sheet Metal Trades on proper locations of balancing damper locations and instrument measurement ports.
    - .5 Balance all supply, exhaust and fresh air quantities noted on drawing or in specification.
    - .6 Specified and achieved air quantities per outlet complete with supporting schematic diagram.
    - .7 Temperature at diffuser farthest from source of air supply.
    - .8 Supply air quantity and temperature where main duct enters space.
    - .9 Return air quantity and temperature where air leaves space.

### 3.02 COMMISSIONING

- .1 Contractor shall provide commissioning for all the new and modified equipment as part of the Work.
- .2 Test and demonstrate all automatic equipment is operating as per sequence of operation (example: test boiler controls package and associated circulating pump interface as an integrated system).
- .3 Ensure manufacturer's representative(s) are present during commissioning activities.
- .4 Provide on-site training instruction to the Owner of the proper operation and maintenance of all Mechanical Equipment installed for a minimum of two 4-hour sessions (total 8 hours).
- .5 Pressure Testing:
  - .1 Do not insulate piping systems until pressure testing has been completed, and proven tight. Should leaks develop in any part of the piping system, remove and replace defective sections, fittings, and other piping system ancillaries.

- .2 Flushing and testing shall be completed prior to connection into building system.
- .3 Hydrostatically test piping at not less than 1.5 times working pressure of final system, but not less than 75 psi (520 kPa), for a period of not less than 12 hours without pumping.
- .4 Test piping system in sections as required by the progress of work.
- .5 Test gas piping in accordance to CGA standard and Authorities Having Jurisdiction (AHJs).
- .6 Existing Equipment:
  - .1 Complete a full review of existing equipment to be re-used as part of the scope of work, confirm that existing equipment controls have undergone recalibration and recertification, a maintenance check and refurbishment (where necessary) or equipment has been performed, and existing equipment is operating as intended.
  - .2 Re-commission BAS controls serving existing equipment to ensure operating sequences are providing functionality as intended.
- .7 Terminal Units (example: VAV Boxes, Fan Coil Units, Heat Pumps):
  - .1 Verify that filters, coils and nozzles are clean, and balanced.
  - .2 Verify that thermostats and actuators are operating as intended.
- .8 Life Safety Integrated Systems Testing (IST):
  - .1 Integrated Systems Testing (IST) is required by the Ontario Building Code (OBC). IST must be conducted in accordance with the requirements of ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems"
  - .2 Test and verify the functionality of all life safety systems provided by multiple design consultant and construction trade disciplines; successful completion of IST is required prior to certification for building occupancy.
  - .3 IST shall include confirmation of integrated systems operation proving fire alarm signaling, fire suppression, smoke control (pressurization), smoke exhaust, or other life safety measures as may be required by the design in response to a fire condition.
- .9 Commissioning Report:
  - .1 Provide a Commissioning Report that includes a description of all Commissioning Activities undertaken and the results thereof. Commissioning Report shall be in a format acceptable to the Consultant.
  - .2 Provide record data of test results to Consultant for review. Include a copy of all the test results in the Commissioning Report.

END OF SECTION

**PART 1 - GENERAL**

**1.01 GENERAL REQUIREMENTS**

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein

**PART 2 - PRODUCTS**

**2.01 RIGGING AND HOISTING**

- .1 Mechanical Trades shall be responsible for all lifting, hoisting and transportation of all equipment on site from the point of delivery to the point of installation.
- .2 Provide all rigging and hoisting as may be required for all system materials and equipment.
- .3 Provide all required supplementary steel supports necessary for mounting or hanging equipment. Equipment being suspended from the floor structure, or supported from or on the roof, with a weight greater than 500 lb. (227 kg), shall have supports reviewed by a Structural Engineer.
- .4 All required supplementary structure as recommended by the Consultant, shall be included in the Bid Price.

**2.02 CONCRETE WORK**

- .1 Provide minimum 4" (100 mm) concrete housekeeping pads, unless noted otherwise, complete with reinforcing steel under all floor mounted mechanical equipment and supports. Extend pads over the full equipment base and isolator area.

**2.03 EQUIPMENT HANGERS AND SUPPORTS**

- .1 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting equipment. All new and relocated existing services and equipment must be supported from the building structure. Design steel to support and distribute operating and static loads. All drilling, approved type inserts and hangers shall be included.
- .2 Support suspended equipment from the bottom or from manufacturer's designated suspension points. Support tanks and similar equipment with adequate beam strength by saddles with curvature to match the equipment. Continuously support all other equipment.
- .3 Auxiliary structural members shall be included and installed where required to accommodate hangers.
- .4 Provide base supports for all pipe risers.
- .5 Fabricate steel supports in contact with water or humidity conditions from materials having approved corrosion resistance or galvanize after fabrication or brush welds clean and apply a prime coat of rust inhibiting paint.
- .6 All supports shall be connected to the top of joists and beams where applicable.
- .7 Suspension from metal deck is not allowed.
- .8 Suspending one hanger from another is not permitted.

**2.04 PIPE HANGERS AND SUPPORTS**

- .1 Generally follow requirements for Equipment Hangars and Supports as modified by this Article.
- .2 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.
- .3 Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 1" (25mm) are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 1½" (40mm) are to be adjustable clevis type.
- .4 Space hangers and supports in accordance with following:
  - .1 cast iron pipe – hang or support at every joint with maximum 8'-0" (2.4m) spacing;
  - .2 plastic pipe – conform to pipe manufacturer's recommended support spacing;
  - .3 steel pipe and copper piping – hang or support at spacing in accordance with following schedule:

Nominal Pipe Size	Steel Pipe Maximum Support Spacing	Cooper Piping Maximum Support Spacing
to ¾" (20mm)	7'-0" (2.1m)	5'-0" (1.5m)
1" (25mm)	7'-0" (2.1m)	6'-0" (1.8m)
1-¼" (32mm)	7'-0" (2.1m)	7'-0" (2.1m)
1-½" (40mm)	9'-0" (2.7m)	8'-0" (2.4m)
2" (50mm)	10'-0" (3.0m)	8'-0" (2.4m)
2-½" (65mm)	11'-0" (3.3m)	9'-0" (2.7m)
3" (75mm)	12'-0" (3.6m)	10'-0" (3.0m)
4" (100mm)	14'-0" (4.2m)	12'-0" (3.6m)
6" (150mm)	17'-0" (5.1m)	14'-0" (4.2m)
8" (200mm)	19'-0" (5.6m)	n/a
10" (250mm)	22'-0" (6.7m)	n/a
12" (300mm)	23'-0" (7.0m)	n/a

- .4 flexible grooved pipe/coupling joint piping – as per table above but with not less than one hanger or support between joints.
- .5 Note that spacing and capacities are based on straight pipe lengths filled with water. Additional valves and fittings increase the load and therefore closer hanger spacing shall be required.
- .5 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 12" (300mm) from elbow, and where pipes drop from tee branches, support tees in both directions not more than 2" (50mm) on each side of tee.
- .6 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.

- .7 Provide roller hangers or supports for heat transfer piping greater than or equal to 6" (150mm) diameter and conveying a material 170°F (75°C) or greater to facilitate pipe movement due to expansion and contraction.
- .8 Unless otherwise shown or specified, space supports for vertical piping in accordance with following:
  - .1 support vertical pipes spaced at maximum 10'-0" (3m) intervals or at every floor, whichever is lesser;
  - .2 for sections of vertical piping with a length less than 10'-0" (3m), support pipe at least once;
  - .3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;
  - .4 for vertical steel pipe risers in excess of 10'-0" (3m), weld shear lugs to pipe to carry load;
  - .5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.
- .9 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.
- .10 For insulated horizontal piping 1¼" (32mm) and larger, provide insulation protection saddles between insulation and hanger or support in accordance with the following table:

<b>Pipe Insulation Saddle Sizing Table - Outside Diameter (in.)</b>						
<b>Pipe Size (inches)</b>	<b>Pipe Insulation Thickness (in.)</b>					
	<b>½</b>	<b>1</b>	<b>1½</b>	<b>2</b>	<b>2½</b>	<b>3</b>
1¼	3	3½	5	5½	6½	7½
1½	3	4	5	5½	6½	7½
2	3½	4½	5½	6½	7½	8½
2½	4	5	6½	7½	8½	9½
3	4½	5½	6½	7½	8½	9½
4	5½	6½	7½	8½	9½	11
6	7½	8½	9½	11	12	13
8	9½	11	12	13	14	15
10	—	13	14	15	16	17
12	—	15	16	17	18	19

- .1 Saddles up to 5½" (140mm) outside diameters shall be 22 gauge galvanized steel, 12" (300mm) long; saddles 6" (150mm) outside diameter and larger shall be 20 gauge galvanized steel, 18" (450mm) long.
- .2 Install saddles immediately after pipe is insulated.



## 2.05 ACCESS DOORS

- .1 Access doors shall be provided for all inaccessible mechanical equipment and services requiring inspection or service. Finish shall suit architect/designers requirements.
- .2 All access doors shall be 12"x12" (300mm x 300mm), except provide 24"x24" (600mm x 600mm) where personnel entry is required.
- .3 Provide to the appropriate trade for installation co-ordinate exact location with other trades and architect. Provide for plaster surfaces, recessed 16 gauge prime painted steel door and welded metal lath, ready to take plaster. Provide with concealed hinge and stainless steel studs with brass sleeves.
- .4 Provide to suit wall surface or type of construction, other factory prime coated access doors of welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps.
- .5 Provide fire rated access doors in fire rated partitions. Provide hinged access doors equal to fire rating of wall or ceiling in which installed.
- .6 Lay-in type ceiling tiles, properly marked, may serve as access panels. Provide stick-on circular tab (approximately ¼" diameter), located on a tee supporting ceiling tile used as access panel, for all new equipment located in ceiling space. (example: VAV terminals)

## 2.06 FLASHING AND COUNTER FLASHING

- .1 Flashing and counter flashing for exterior mechanical service penetrations or penetration of water-proofed floors shall be provided by Mechanical Trades.
- .2 Flash all mechanical parts passing through, or built into a roof, outside wall or waterproof floor.
- .3 Use prefabricated aluminum or PVC flashings for roof, and membrane or copper for walls and floors.
- .4 Ensure all openings are weather, water and fire proof, using an approved flexible sealant.

## 2.07 ELECTRIC MOTORS

- .1 CSA labelled, and except where specifically noted.
- .2 Motors ½ HP rated capacity and smaller shall be 120V/1Ø, /60Hz; motors ¾ to 1½ HP shall be 208V/3Ø, /60Hz; motors 2 HP and larger shall be 600V/3Ø, /60Hz.
- .3 All motors over 1/3 HP to be Open Drip Proof ("ODP") unless noted otherwise. Motors 20 HP and larger provide thermistor over temperature protection for each winding, wire in series, with leads terminated in the motor junction box.
- .4 All Motors to meet NEMA standards for maximum sound level ratings under full load. Service factor on all motors to be 1.15.
- .5 All motors over 1 HP to be high efficiency type with ratings based on statistically valid Quality Control procedures conforming to ANSI/IEEE 112 (Ref. 10), Test Method B (dynamometer), using NEMA MG1 (MG1-12.54 and MG1-12.55) (Ref.11), and conforming to efficiency ratings as defined in Table 10.4.1.A (a) under SB-10 of Ontario Building Code. Motors to be approved under the Canadian Electrical Safety Code.
- .6 Motor bearings: to be permanently lubricated ball type for motors up to and including 5 HP. Bearings for all motors over 5 HP to be self-aligning greaseable ball bearings sized to provide life of at least 50,000 hours L-10 life under belt driven service.

- .7 Motors used in applications where Variable Frequency Drives (VFDs) are employed shall be complete with:
  - .1 motor winding insulation suitable for the intended application, and
  - .2 motor bearing protection rings (motor bearing grounding rings), to redirect stray shaft currents to the motor frame bypassing the motor bearings.
- .8 Acceptable electric motor manufacturers: WEG, US Motors, Westinghouse, General Electric, Baldor-Reliance, Brook-Crompton, Marathon

## 2.08 VARIABLE FREQUENCY DRIVES (VFDS)

- .1 General Requirements:
  - .1 Provide Variable Frequency Drives (VFD's) equal to Danfoss, complete with LCD display, for the equipment as per schedules and drawings
  - .2 Each VFD shall be CSA approved, tested to UL 508C, and bear the appropriate cUL certification label. VFD shall be manufactured in ISO 9001, 2000 certified facilities.
  - .3 The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating.
  - .4 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
  - .5 The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients.
  - .6 The VFD's full load output current rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.
  - .7 Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.
  - .8 VFD shall contain integral EMI filters to attenuate radio frequency interference conducted to the AC power line.
  - .9 VFD shall be housed in a NEMA 1 Enclosure with conformally coated circuit boards.
  - .10 VFD shall include integral main disconnect switch deigned to isolate input power to VFD.
- .2 Bypass:
  - .1 Provide a 3 Contactor Electro-Mechanically Controlled bypass consisting of a door interlocked main fused disconnect switch, built in motor starter and a 4 position DRIVE/OFF/BYPASS/TEST controlling three contactors.

- .2 In the DRIVE position the motor shall be operated by the VFD. In the OFF position the motor and VFD are disconnected. In the BYPASS position the motor is operated directly from the AC line and the VFD is disconnected. In the TEST position the motor is operated directly from the AC line, but the VFD is powered on the input only allowing for testing during repair.
- .3 Remote safety contacts are provided to ensure safe shutdown whether in VFD or Bypass mode.
- .4 A common Run/Stop circuit shall be provided to control both the VFD and Bypass mode.
- .3 Protective Features:
  - .1 A minimum of Class 20 I2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.
  - .2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
  - .3 Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
- .4 Interface Features:
  - .1 Hand, Off and Auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.
- .5 Standard Control and Monitoring Inputs and Outputs:
  - .1 Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
  - .2 Two terminals shall be programmable to act as either a digital output or additional digital inputs.
  - .3 Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status. Each relay shall have an adjustable on delay / off delay time.
  - .4 Two programmable analog inputs shall be provided that can be either direct-or-reverse acting. Each shall be independently selectable to be used with either an analog voltage or current signal. The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA. A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise. The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,
  - .5 One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.

- .6 Serial Communications:
  - .1 The VFD shall include a standard communications port and capabilities to be connected using the BACnet MSTP serial communication protocol at no additional cost and without a need to install any additional hardware or software in the VFD.
- .7 Start-up and Warranty:
  - .1 The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician that is experienced in start-up and repair services.
  - .2 The complete VFD shall be warranted by the manufacturer for a period of 18 months from date of shipment. The warranty shall include parts, labour, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service.

## 2.09 NOISE AND VIBRATION

- .1 Mechanical equipment is to operate without objectionable noise or vibration. If, in the opinion of the Consultant, the equipment operates with excessive noise or vibration, then the equipment must be replaced or noise or vibration eliminated.
- .2 Connections to noise-producing and vibrating equipment must be made with flexible connection. Refer to details for more information.
- .3 Vibration isolators are to be provided where indicated or required.

## 2.10 PRESSURE GAUGES AND THERMOMETERS

- .1 Pressure gauges – No. 600 Series to ANSI Standard B40, Grade A, fully adjustable, 4-1/2" (115 mm) diameter, complete with a cast aluminum casing, clear glass window, white dual scale (psi and kPa) dial, red tipped black pointer, bronze bushed movement, pressure snubber, and "T" handle gauge cock;
- .2 Thermometers – No. BX93403-1/2 CAN/CGSB Standard 14.4-M88 fully adjustable angle, 9" (225 mm) white dual scale (degrees F. and degrees C.), complete with cast aluminum case, clear acrylic window lens, front red reading mercury tubing, separable brass socket, brass piping well, and extension necks where used in insulated pipe or equipment.
- .3 Instruments and associated accessories shall be registered with Technical Standards and Safety Authority (TSSA) and shall be complete with a CRN No. Where possible, the CRN No. shall be permanently fixed to the component.
- .4 Pressure gauge and thermometer scale ranges shall be such that the working temperature or pressure of the system for which the instrument is provided is at approximately the mid-point of the instrument scale.

## PART 3 - EXECUTION

### 3.01 MUNICIPAL AND UTILITY SERVICES

- .1 Co-ordinate, arrange, and pay for (provide cost to Landlord/Owner) all utility connections and fees as required, and shown on the Drawings, complete with all required metering. Install all metering equipment in accordance with municipal or utility requirements.

### 3.02 CUTTING, PATCHING AND CORE DRILLING

- .1 Any required cutting, patching and core drilling required to perform the Mechanical Work shall be included by the Mechanical Trades. Perform cutting in neat and true fashion, with proper tools and equipment to owner's approval. Patch surfaces to exactly match existing finishes. Utilize tradesmen skilled in particular trade or application worked on to Landlord/Owner's approval.
- .2 X-Ray concrete structure in accordance with Landlord/Owner structural engineer's requirements. Verify exact location of core drilling to check for existence of any services (example: electrical conduit, structural re-bar) with Landlord/Owner and Landlord/Owner's structural engineer.
- .3 Provide details of new openings through structural components for engineer's approval. Incur all related costs to obtain structural engineer's approval.
- .4 For exterior and/or underground penetrations, provide waterproof, weather-tight, fire rated materials in compliance with local governing authority and code requirements to seal openings.
- .5 Patch fire rated partitions and floor to maintain ULC listing for rating upon removal of mechanical services originally spanning fire rated assembly.
- .6 Ensure areas of both sides of surface being cut are protected from debris. Be responsible for damage done to existing building and services caused by cutting or drilling.

### 3.03 GENERAL REQUIREMENTS FOR ALL VALVES

- .1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification, however, regardless of locations shown or specified, following requirements shall apply:
  - .1 except for fire protection systems, provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;
  - .2 for fire protection systems, provide supervised shut-off valves in accordance with the system design requirements;
  - .3 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;
  - .4 unless otherwise specified, provide a check valve in discharge piping of each pump;
  - .5 unless otherwise specified, provide a strainer upstream of each pump, plate and frame heat exchanger, water meter, pressure regulating valve, and control valve;
  - .6 valve sizes are to be same as connecting pipe size;
  - .7 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be from the same manufacturer.
- .2 For valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

### 3.04 TEMPORARY FILTERS

- .1 Cover open end of all base building return air openings including registers, return or exhaust air ducts which are to remain operational during construction with 1" (25mm) thick filter media secured by metal band pulled tight around duct.

- .2 Filters shall be replaced weekly.
- .3 Remove filters upon construction completion.
- .4 Maintain this condition until plastering, drywall and other finishing operations are complete.

### 3.05 MECHANICAL WIRING

- .1 All power wiring for mechanical equipment shall be provided by Electrical Trades unless noted otherwise. Confirm the voltage and phase characteristics on site with the Electrical Trades prior to producing shop drawings and ordering equipment.
- .2 All control wiring, line or low voltage, shall be by Mechanical Trades; follow Electrical Trades wiring specifications.

### 3.06 CHEMICAL TREATMENT

- .1 Perform piping system cleaning and water treatment services under the supervision of the Base Building Water Treatment Specialist.
- .2 Clean and degrease the piping systems prior to connection to the base building system. Clean strainer baskets as often as necessary during cleaning and degreasing. Verify chemical treatment and antifreeze concentrations with the Base Building Water Treatment Specialist.
- .3 Add chemical solution to system, circulate for periods required, drain and refill. Repeat chemical treatment rinse. Refill the system, and connect to base building condenser water system.
- .4 Maintain chemical levels from the time the system is filled after cleaning, up to Substantial Performance of the Contract.
- .5 Provide service visits during Warranty period as required to stabilize and commission the systems. Perform corrosion tests to verify performance requirements are being achieved. Document recommendations and submit a written report to the Owner's representative after each visit.
- .6 Pipes intended to carry potable (drinking) water shall be flushed and disinfected before being placed in service.
  - .1 Disinfection procedures shall conform to AWWA C601 and AWWA C651, and the requirements of the Authorities Having Jurisdiction (AHJs).
  - .2 Where stainless steel piping is used for domestic water applications, piping systems shall be annealed, de-greased and pickled, and will be subject to formal cleaning and disinfecting along with all other parts and components of the domestic water system as per ASTM A-380.

### 3.07 FIRE STOPPING

- .1 Mechanical service penetrations of required fire separations shall be fire stopped using ULC listed fire stopping products that have been tested in accordance with CAN4-S115.
- .2 Repair and/or provide all fire stopping affected by the Mechanical Work to maintain required listed ratings of fire separations.

### 3.08 PRESSURE GAUGES AND THERMOMETERS

- .1 Provide pressure gauges with cocks in the following locations:

- .1 in valved tubing across the suction, suction strainer (if applicable), and discharge piping of each circulating pump;
- .2 Where noted on the drawings
- .2 Thermometers in ductwork shall be equipped with Trerice No. 065-0015 or equal mounting flanges.
- .3 Provide an angle type or straight type thermometer in the following locations:
  - .1 Where noted on the drawings

### 3.09 IDENTIFICATION OF EQUIPMENT AND PIPING

- .1 Identify all automatic control devices and motor driven equipment with 1/8" (3mm) lamacoid plastic plates with beveled edges having engraved white letter on black background giving the nature of equipment service and its number (example: "Washroom Exhaust EF-1"), and similar. Provide plates with 1/4" (6mm) lettering for motor starters and 1/2" (12mm) lettering for equipment.
- .2 Fix nameplates to equipment using sheet metal screws or brass chains.
- .3 Valves adjacent to plumbing fixtures, convectors, unit heaters and entrance heaters need not be tagged.
- .4 Prepare an approved list detailing the valve location, tag numbers and purpose it serves. Turn over to the Landlord/Owner and provide additional copies for the O&M Manuals.
- .5 Where equipment is locally switched (example: room exhaust fans) provide suitable label at switch. Co-ordinate with architect on site for labeling the switches in an aesthetically pleasing manner.
- .6 Coordinate with controls subcontractor and obtain list of automatically operated equipment and provide warning identification on lamacoid plate for each item as follows:  
  
*"Warning: This equipment may start at any time. Do not service without disconnecting power."*
- .7 Identify the following piping as to service and direction of flow using stencils and black lettering behind each access door, in each room, and/or every 40 ft. (12m).
  - .1 Gas (identify to code requirements).
  - .2 Sprinkler system.
  - .3 Supply air and fan system identification
  - .4 Return air and fan system identification

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein.
- .3 Comply with requirements of Section 20 10 10 Basic Materials and Methods, and all documents referred to therein

1.02 WORK INCLUDED

- .1 Perform all Insulation work as indicated in the Specifications, Drawings and other referenced Contract Documents.
- .2 Execute work of this Section only by skilled tradesmen regularly employed in the application of insulation of mechanical systems.
- .3 Provide pipe, ductwork and equipment insulation with maximum flame spread rating of 25 and smoke development classification of 50 in accordance with CAN/ULC S102.2.
- .4 All existing exposed ductwork and piping insulation to be inspected and repaired as required.
- .5 The word "exposed" where used in this Section means any work which is not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors in closets or cupboards or under counters is not considered to be exposed.
- .6 Concealed insulated items require no further finish than provided in factory applied jacket. Cover exposed insulation and all insulated equipment with canvas, field applied, adhered and lap sealed and finished off by a brush coat of approved sizing. Paint and label canvas as noted in specifications or drawings.

PART 2 - PRODUCTS

2.01 DUCTWORK INSULATION

- .1 Provide external ductwork insulation in thickness as listed below.
- .2 Insulate all supply air ductwork from unit outlet of air handling systems delivering air at temperatures less than 64°F (18°C) and greater than 86°F (30°C). This includes supply air ductwork connected to fan coil units, heat pumps, VAV/CAV terminals, air handling systems with cooling and/or heating coils, and direct or indirect fired burner sections.
- .3 Material to ASTM C1290 "Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts"
  - .1 FSK jacket of kraft bonded to aluminum foil reinforced with glass fibre yarn
  - .2 thermal performance:  $R = 4.2 \text{ sq.ft.}^\circ\text{F}\cdot\text{hr}/\text{BTU} @ 75^\circ\text{F}$  ( $0.74 \text{ sq.m.}^\circ\text{C}/\text{W} @ 24^\circ\text{C}$ )
  - .3 density: 0.75 lb/cu.ft (12 kg/cu.m)
  - .4 Rated 25/50 per ASTM E84, UL 723 and NFPA 255
  - .5 vapor transmission : maximum 0.02 perms



- .4 Provide 1½" (40 mm) (thick for systems with 64°F (18°C) or less air supply temperature.
- .5 Provide 1½" (40 mm) thick for systems with 86°F (30°C) or greater air supply temperature.
- .6 Outdoor intake ductwork, ductwork conveying mixed outdoor/return air and mixed air plenums: 4" (100mm) thick applied in two (2) layers of 2" (50mm) thick insulation on staggered centres.
- .7 Return air ductwork located outdoors: 4" (100mm) thick applied in two (2) layers of 2" (50mm) thick insulation on staggered centres.
- .8 Exhaust ductwork located outdoors: 4" (100mm) thick applied in two (2) layers of 2" (50mm) thick insulation on staggered centres.
- .9 Exhaust ductwork located indoors for a minimum of 20 ft. (6m) back from the discharge point to outdoors: 2" (50mm) thick.
- .10 Where specifically noted on drawings that could be an exception to the foregoing.

## 2.02 DUCTWORK INSULATION EXCEPTIONS

- .1 External duct insulation is not required where:
  - .1 Supply air ductwork installed exposed within conditioned space.

NOTE: Supply air ductwork installed concealed in ceiling spaces, whether used as return air plenums or not, is to be completely insulated.

- .2 Ductwork is internally insulated.
- .2 Acoustic type flexible ductwork is used.
- .3 Duct silencers are installed.

## 2.03 PIPING INSULATION

- .1 Drains and water supplies for Barrier-Free lavatories and sinks:
  - .1 Provide non-premolded pipe insulation on exposed water supplies and drain under lavatory and finish with canvas.
- .2 Preformed fiberglass pipe insulation, complying with ASTM C 547, Class 3 to 850°F. (454°C.), rigid, moulded pipe insulation, non-combustible and conforming with the following:
  - .1 reduced environmental impact feature of either: bio-based binders, 25% minimum recycled glass content, and/or paper-free ASJ jacket material.
  - .2 thermal performance: 0.23 BTU/hr/in/sq.ft/°F @ 75°F (0.033 W/m/°C @ 24°C)
  - .3 service temperature: 0°F (-18°C) to jacket surface temperature (air contact) of 150°F (66°C) and un-jacketed surface temperature (equipment contact) up to 450°F (232°C).
  - .4 noncombustible meeting 25/50 flame spread/smoke developed when tested to ASTM E84, UL 723 and NFPA 255;
  - .5 when used over stainless steel, product must comply with ASTM C795 "Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel".
- .3 For cold service provide vapour retardant jacketing as follows:

- .1 ASJ white jacket of "KRAFT" paper-free bonded to aluminum foil reinforced with glass fibre yarn and self-sealing longitudinal laps and butt strips, maximum 0.02 perms to ASTM E96 Procedure A.

.4 Piping Insulation Application Schedule:

Item	Insulation Thickness & Type
Traced piping (where indicated)	Indoors: 25mm (1") minimum for applications not listed in this table. Outdoors: 50mm (2").
Condensate, horizontal drains from fan coil units, heat pumps and cooling coils, suspended horizontal drains receiving cooling coil condensate,	25mm (1") premolded.
Heating system Piping	1½" (40mm) premolded
Glycol Circuits	1½" (40mm) premolded.
Heat Pump Piping	2" (50mm) for heat sink side (example: ground source): water to air, and water to water type.  Supply side within the building to be insulated as specified for chilled water.

2.04 FLEXIBLE ELASTOMERIC CLOSED CELL FOAM INSULATION:

- .1 Material to ASTM C534 "Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form"
  - .1 Thermal performance: 0.28 BTU/hr/in/sq.ft/°F @ 75°F (0.04 W/m/°C @ 24°C) established in accordance with ASTM C 177 "Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus" or ASTM C 518 "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus";
  - .2 CAN2-51.40-M80+Amendment-Aug-83 "Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering", flexible fire retardant elastomeric unicellular sheet and pipe covering;
  - .3 Pipe size application: up to and including 6" (150mm)
  - .4 Service temperature: -40°F to 203°F (-40°C to 95°C)
  - .5 Tubular with self-sealing seams

Item	Insulation Thickness & Type
Refrigeration suction and hot gas lines	1½" (40mm) thick for pipe up to and including 1" (25 mm). 1¾" (45mm) thick for 1¼" (32 mm) pipe sizes to 2" (50 mm).
Equipment Drains	¾" (20 mm) thick for pipe up to and including 6" (150mm).

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- .1 Install pipe, ductwork and equipment insulation in accordance with the Manufacturer's requirements and the requirements of the Authorities Having Jurisdiction (AHJs).

END OF SECTION

**PART 1 - GENERAL**

**1.01 GENERAL REQUIREMENTS**

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein.
- .3 Comply with requirements of Section 20 10 10 Basic Materials and Methods, and all documents referred to therein

**1.02 WORK INCLUDED**

- .1 Provide all parts of the HVAC Piping and Pump systems and related components as indicated in the Specifications, Drawings and other referenced Contract Documents.
- .2 Refrigerant piping design and installation shall conform to the requirements of CSA Standard B52 - Mechanical Refrigerant Code, Ontario Building Code, Air Conditioning and Refrigerant Institute and Air Conditioning Equipment Manufacturer.

**PART 2 - PRODUCTS**

**2.01 REFRIGERATION PIPING:**

- .1 Refrigerant piping shall be factory-cleaned and sealed, type ACR seamless copper piping. Use only silver brazed joints.
- .2 Select pipe, fittings and components to suit system test and operating pressures.
- .3 Size refrigerant piping to attain air conditioning equipment manufacturers listed cooling capacities keeping piping runs and number of elbows and fittings to a minimum.
- .4 Refrigerant piping to be type "L" hard temper copper tubing with Silfos or flared joints may be used. Use long radius elbows only.
- .5 Reduce the effect of piping vibration with the use of flexible metal hose.
- .6 Piping to remote condensing unit shall include shut off valves and unions.
- .7 Ensure refrigeration piping is dehydrated, tested and adequately charged. Refrigerant piping will not be accepted unless it is gas tight.
- .8 Install refrigerant piping in a neat workmanlike manner with horizontal runs sloped towards the compressor at a rate of 4%. Support lines at intervals of not more than 8'-0" (2.4m) with suitable anchors. Use rubber grommets between tubing and clamps to prevent line chafing.
- .9 Provide permanent guards as required to protect piping and fittings from damage.
- .10 Refrigerant system and piping to be tested to industry standards.

**PART 3 - EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- .1 Install HVAC Piping and Pump systems and components in accordance with the Building Code requirements, Manufacturer's requirements, and the requirements of the Authorities Having Jurisdiction (AHJs).
- .2 Refrigerant system and piping to be tested to industry standards.

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein.
- .3 Comply with requirements of Section 20 10 10 Basic Materials and Methods, and all documents referred to therein

1.02 WORK INCLUDED

- .1 Provide all parts of the HVAC Air Distribution System and related components as indicated in the Specifications, Drawings and other referenced Contract Documents.
- .2 Provide ductwork and hangers in accordance with SMACNA and ASHRAE standards.

PART 2 - PRODUCTS

2.01 GENERAL DUCTWORK REQUIREMENTS

- .1 Fabricate ductwork from galvanized sheet metal with a minimum zinc coating thickness of 0.60 oz/sq.ft. (0.5mm) on both sides (G60 coating) unless other materials are specifically named.
- .2 Seal all transverse joints in supply, return and exhaust ductwork with water based, low VOC content, high velocity duct sealant with service temperatures -25°F to 220°F (-31.7°C to 104.4°C), pressures up to 15in.wg, (3.75kPa) mold resistant to UL 181B. Duct tape not acceptable.

2.02 FLEXIBLE DUCTWORK

- .1 Connect flexible ductwork with a minimum of three (3) self-tapping screws, seal with duct sealer and wrap with glass fab tape.
- .2 Flexible ductwork to be supported from building structure where it is not self-supporting and must not be allowed to lie on ceiling or other equipment.
  - .1 Flexible ducting shall be equal to CEH – Type HPB by Peppertree Air Solutions Inc.
  - .2 Acoustic flexible ducting core shall be constructed of a spirally wound strip of acoustic rated CPE interlocked with an external helix; wrapped in Owens Corning GREENGUARD Gold Certified FIBERGLAS insulation; and sleeved by a black flame retardant low-density antistat polyethylene vapor barrier.
- .3 Acoustic flexible ducting shall be ULC-S110 Listed as Class 1 Air Duct Connector with a Flame Spread Rating of not over 25 without evidence of continued progressive combustion and a Smoke Developed Rating of not over 50.

2.03 BALANCING DAMPERS

- .1 Provide single blade, splitter dampers in duct sizes up to 12" (300mm) deep constructed of not less than 20 gauge damper blades using the same material as duct. Reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware, quadrant regulator with backup washers to prevent leakage, long square bearing pin, slide pin, and locking device.

- .2 Provide manufactured multi-blade balancing damper in duct sizes greater than 12" (300mm) deep of material compatible with duct with opposed blades each not wider than 9" (228mm), pin in bronze bushing bearings, linkages with shaft extension and locking quadrant.
- .3 Provide spin-on connectors complete with balancing damper at take-off for grilles and diffusers from main duct.

#### 2.04 GRILLES, DIFFUSERS AND REGISTERS

- .1 Provide standard product as indicated in the Equipment Schedules to meet capacity, throw, noise level, and throat and outlet velocity as manufactured by Nailor, Price, or equal as accepted by the Consultant.
  - .1 Final finish to be selected by Architect from standard manufacturer finishes as part of Shop Drawing review.

#### 2.05 LINED DUCTWORK

- .1 Provide internally lined ductwork where indicated on the drawings. Lining to be 1" (25mm) thick, 1.5 lb/cu.ft (25 kg/cu.m) density fibreglass with neoprene coating. Seal all cut edges of fiberglass duct liner, wrapped insulation, rigid fiberglass duct board and foam insulation to provide complete coverage and encapsulation of exposed insulation ensuring exposed insulation does not come into contact with air stream.
- .2 Duct sizes to increase accordingly to maintain equivalent free area.
- .3 All transfer air ductwork to be internally lined.

#### 2.06 EXPOSED RETURN AIR OPENING

- .1 All services above return air grilles to be painted flat black.

#### 2.07 TRANSFER AIR OPENINGS

- .1 Transfer air openings, where indicated without ductwork extension, shall be the responsibility of the Mechanical Trades to advise General Contractor regarding size and location required.

#### 2.08 FLEXIBLE CONNECTIONS

- .1 ULC listed and labelled, neoprene coated, glass fabric, factory fabricated as approved by the Authorities Having Jurisdiction (AHJs). Connection must not be under tension.

#### 2.09 VRF HEADS

- .1 Refer to enclosed equipment cut sheets for the VRF heads and related temperature controls.

### PART 3 - EXECUTION

#### 3.01 GENERAL REQUIREMENTS

- .1 Install HVAC Air Distribution Systems and components in accordance with the Building Code requirements, Manufacturer's requirements, and the requirements of the Authorities Having Jurisdiction (AHJs).

#### 3.02 FLEXIBLE DUCTWORK

- .1 At the inlet of each VAV terminal control unit, provide a minimum of three (3) diameters of straight flexible ductwork; maximum length 4'-0" (1200mm).

- .2 Flexible ducts serving diffusers shall be installed as one continuous piece and shall not exceed 10'-0" (3m) lengths.

**3.03 BALANCING DAMPERS**

- .1 Provide air balancing dampers as follows:
  - .1 at each branch duct connection from a main trunk duct (branch ducts serve more than one terminal device, diffuser, grille, or register);
  - .2 at each duct run-out to an individual terminal device, diffuser, grille, or register;
  - .3 where indicated on the Drawings.

**3.04 GRILLES, DIFFUSERS AND REGISTERS**

- .1 Exactly locate grilles, diffusers and registers to conform to the final architectural reflected ceiling plans and detailed wall elevations, and to conform to the final lighting arrangement, ceiling layout, ornamental, and other wall treatment.
- .2 Supply plaster frames for installation by Drywall Trades for grilles and diffusers installed in plaster or drywall finishes. Fit frames tightly to prevent leakage and smudging.

END OF SECTION



PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein.
- .3 Comply with requirements of Section 20 10 10 Basic Materials and Methods, and all documents referred to therein

1.02 WORK INCLUDED

- .1 Provide all parts of the Electric Heating systems and related components as indicated in the Specifications, Drawings and other referenced Contract Documents.
- .2 All electric heaters shall be CSA approved and ULC listed.

PART 2 - PRODUCTS

2.01 ELECTRIC BASEBOARD HEATERS

- .1 Electric baseboard heater equal to Stelpro model B, CSA Certified, capacity and voltage as noted on the Drawings, 22-gauge steel casing construction capable of supporting 165 lb. (75 kg) centre point load, full-length wireway, cabinet designed for even heated air distribution, with epoxy-polyester powdercoat white (standard).
- .2 Element: single tubular, stainless steel sheathed element with boxed aluminum fins, secured at unit centre, floating in nylon sleeves at each end to compensate for expansion and contraction.
- .3 Control: complete with low voltage relay kit (left junction box only) suitable for electronic wall mounted temperature sensor (by BAS Trades), or optional built-in thermostat installed in the left or right junction box.

2.02 ELECTRIC CABINET UNIT HEATERS

- .1 Wall Mounted Cabinet Heater:
- .2 Wall Mounted Cabinet Heater equal to Stelpro model WF, CSA Certified, capacity and voltage as noted on the Drawings, 20-gauge steel cabinet, 18-gauge punched steel grille, top air intake with bottom air discharge, epoxy-polyester powdercoat standard white finish.
  - .1 Fan: single unit 1 x 160 CFM; double unit 2 x 160 CFM; triple unit 3 x 160 CFM; closed and permanently lubricated three-speed motor.
  - .2 Element: high-quality nichrome element, thermal protection with automatic reset.
  - .3 Control: three (3) speed control knobs (white, soft white and black) included for standard installation, without control knob for tamper-proof installation. External temperature sensor (by BAS Trades); provide transformer kit for multiple unit control from common temperature sensor. Where noted provide optional built-in thermostat.
  - .4 Installation: recessed wall mounted, or surface mounted with surface adapter.
- .3 Ceiling Mounted Cabinet Heater:

- .1 Wall Mounted Cabinet Heater equal to Stelpro model CF, CSA Certified, capacity and voltage as noted on the Drawings, 20-gauge steel cabinet, 18-gauge punched steel grille, top air intake with bottom air discharge, epoxy-polyester powdercoat standard white finish.
- .2 Fan: single unit 1 x 160 CFM; double unit 2 x 160 CFM; closed and permanently lubricated three-speed motor.
- .3 Element: high-quality nichrome element, thermal protection with automatic reset.
- .4 Control: three (3) speed control knobs (white, soft white and black) included for standard installation, without control knob for tamper-proof installation. External temperature sensor (by BAS Trades); provide transformer kit for multiple unit control from common temperature sensor. Where noted provide optional built-in thermostat.
- .5 Installation: recessed ceiling mounted, or surface mounted with surface adapter, or T-bar ceiling adaptor.

#### 2.03 ELECTRIC CEILING VERTICAL DISCHARGE HEATERS

- .1 Electric Ceiling Vertical Discharge Heaters equal to Stelpro model Dragon, CSA Certified, with output capacity of 2 kW to 10 kW, and voltage as noted on the Drawings, manufactured from 20-gauge steel cabinet and 14-gauge steel grille, helicoidal fan, thermal protection with automatic reset, closed and permanently lubricated motor, epoxy-polyester powdercoat standard white, or soft white finish. DRR model, or equal shall be ceiling recessed in a T-bar; DRI and DRII models, or equal, shall be ceiling surface mounted with bracket to support unit.
- .2 Element: nichrome heating element
- .3 Control: wall mounted electronic thermostat (by BAS Trades). Fan-only mode for continuous air circulation, controlled by built-in selection switch; fan-only mode available for use with wall-mounted switch. Heating mode, confirmed by pilot light when heating is ON. Connection of multiple units to the same thermostat is possible with a relay kit and an external transformer. 2 to 6 wires required for connections according to the selected control mode.

#### 2.04 SUSPENDED ELECTRIC UNIT HEATERS:

- .1 Suspended Electric Unit Heaters shall be equal to Stelpro model RUH and be CSA Certified, with capacities from 1500W to 5000W and voltage in accordance with the Drawings and/or Equipment Schedules.
  - .1 Suspended Electric Unit Heaters shall be constructed with a 20-gauge steel cabinet and complete with a totally enclosed permanently lubricated motor, 350 CFM capacity helicoidal fan, adjustable directional louvers, nichrome heating element with thermal protection and automatic reset. Heater shall be epoxy-polyester powdercoat finish with charcoal colour.
  - .2 Control: External temperature sensor (by BAS Trades); provide transformer kit for multiple unit control from common temperature sensor. Where noted provide optional built-in thermostat.
  - .3 Installation: wall hung or ceiling mounted with universal mounting bracket.
- .2 Large Capacity Suspended Electric Unit Heaters shall be equal to Stelpro model SHU and be CSA Certified, with capacities from 2kW to 60kW and voltage in accordance with the Drawings and/or Equipment Schedules.

- .1 Large Capacity Suspended Electric Unit Heaters shall be constructed with a 18-gauge steel cabinet and complete with a totally enclosed permanently lubricated motor, helicoidal fan, adjustable directional louvers, protective screen, nichrome heating element with thermal protection and automatic reset. Heater shall be epoxy-polyester powdercoat finish with charcoal colour.
- .2 Control: External temperature sensor (by BAS Trades); provide transformer kit for multiple unit control from common temperature sensor. Where noted provide optional built-in thermostat.
- .3 Installation: wall hung or ceiling mounted with universal mounting bracket. Minimum distance from adjacent walls: 6" (153mm) for units 2 kW to 30 kW capacity; 12" (305mm) for units 40 kW to 60 kW capacity. Mounting heights: 2 to 8 ft. (610mm to 2440mm) for units 2 kW to 10 kW; 2 to 10 ft. 610mm to 3050mm) for units 15 kW to 30 kW units; 15 to 20 ft. (4575mm to 6100mm) for units 40 kW to 60 kW capacity.

#### 2.05 ELECTRIC DUCT HEATERS

- .1 Electric Duct Heaters equal to Stelpro model SDHI (insertion type), SDHF (flange connection) and SDHR (round connection), cUL Listed, capacity and voltage as noted on the Drawings, corrosion resistant galvanized steel cabinet (20 to 16 gauge), junction box door, double thermal protection (manual and automatic), optional neoprene gasket, Nema 4x control box, and optional stainless steel element housing.
- .2 Elements: open, nichrome elements; SCR modulation of the elements to maintain a constant supply air temperature.
- .3 Controls: External temperature sensor (by BAS Trades); provide transformer kit, electronic air velocity sensor; built-in high limit temperature limit sensor; heater interlock included.
  - .1 control voltage: 0-10 V, 2-10 V (4-20mA), 24Vac (PWM), or 24Vdc for 3 stage modulating control (0-40-70-100%); refer to sequence of operations.

#### 2.06 ACCEPTABLE ELECTRIC HEATING MANUFACTURERS

- .1 Acceptable manufacturers are:
  - .1 Stelpro Design Inc.;
  - .2 Ouellet Canada Inc.;
  - .3 Chromalox Inc.;
  - .4 Or equal as approved by the Consultant.

### PART 3 - EXECUTION

#### 3.01 GENERAL REQUIREMENTS

- .1 Install Electric Heating systems and components in accordance with the Building Code requirements, Manufacturer's requirements, and the requirements of the Authorities Having Jurisdiction (AHJs).

#### 3.02 ELECTRIC BASEBOARD HEATERS

- .1 Install electric baseboard heaters surface mounted with knockouts for the BX and cable clamps at each end, mounting holes spaced at 1" (25mm) intervals along the top and the bottom.

3.03 ELECTRIC CABINET UNIT HEATERS

- .1 Wall Mounted Cabinet Heaters shall be recessed wall mounted, or surface mounted with surface adapter.
- .2 Ceiling Mounted Cabinet Heaters shall be recessed ceiling mounted, or surface mounted with surface adapter, or T-bar ceiling adaptor.

3.04 ELECTRIC CEILING VERTICAL DISCHARGE HEATERS

- .1 Heaters shall be install at a minimum distance from adjacent or surrounding walls: 12" (DRR or DRI models); 24" (DRII models). Heaters shall be ceiling surface mounted or ceiling recessed, suspended at a minimum of 8'-0" from the floor for 2 kW or 3 kW units; 10'-0" from floor for 4 kW or 5 kW units; 12'-0" for 7.5 kW or 10 kW units.

3.05 SUSPENDED ELECTRIC UNIT HEATERS

- .1 Suspended Electric Unit Heaters shall be wall hung or ceiling mounted with universal mounting bracket.
- .2 Large Capacity Suspended Electric Unit Heaters shall be wall hung or ceiling mounted with universal mounting bracket.
  - .1 Minimum distance from adjacent walls: 6" (153mm) for units 2 kW to 30 kW capacity; 12" (305mm) for units 40 kW to 60 kW capacity.
  - .2 Mounting heights: 2 to 8 ft. (610mm to 2440mm) for units 2 kW to 10 kW; 2 to 10 ft. 610mm to 3050mm) for units 15 kW to 30 kW units; 15 to 20 ft. (4575mm to 6100mm) for units 40 kW to 60 kW capacity.

3.06 ELECTRIC DUCT HEATERS

- .1 Install duct heaters in the vertical, horizontal, upflow or downflow position, certified "zero" clearance from flammable materials, round duct minimum 4" (100mm) for SDHR model; rectangular duct minimum 6" x 6" (150mm x 150mm) for SDHI and SDHF models.

END OF SECTION

**PART 1 - GENERAL**

**1.01 GENERAL REQUIREMENTS**

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein.
- .3 Comply with requirements of Section 20 10 10 Basic Materials and Methods, and all documents referred to therein

**1.02 WORK INCLUDED**

- .1 Provide all parts of the Glycol Snow Melting Systems and related components as indicated in the Specifications, Drawings and other referenced Contract Documents.

**PART 2 - PRODUCTS**

**2.01 TUBING**

- .1 Tubing embedded in concrete shall be high density cross linked polyethylene tubing in accordance with ASTM F877 as certified by NSF or CSA. All tubing shall be fully cross linked to the specified standard prior to shipment from the manufacturing facility.
- .2 All piping shall be rated at 180°F (82.2°C) maximum working temperature and up to 100 psi (690 kPa) working pressure in accordance with ASTM standard F876 and F877. Tubing shall have 100% thermal memory when heated to 266°F (130°C).
- .3 The minimum bend radius for cold bending of the tubing shall not be less than five (5) times the outside diameter. Bends with a radius less than stated will require the use of a bend support by the tubing manufacturer.
- .4 Tubing shall be provided with an oxygen diffusion barrier. Oxygen diffusion barrier shall be capable of limiting oxygen diffusion through the tube to no greater than 0.10/g/cu.m/day at 104°F (40°C) water temperature.
- .5 Steel, copper, polybutylene, polypropylene, nitrile, polyester, rayon, neoprene and rubber piping are not acceptable.

**2.02 FITTINGS AND MANIFOLDS**

- .1 Tubing fittings shall be manufactured of dezincification resistant brass. These fittings must be supplied by the tube manufacturer. The tube fitting consists of a barbed insert, a serrated compression ring and a nut and be capable of connecting to the manifold or tube splice.
- .2 Manifolds shall be of cast bronze construction and shall have integral loop balancing and loop control valves. Supply and return manifolds shall be able to vent air from the system and shall be provided with support (mounting) brackets. Manifolds shall be isolated from supply and return piping with valves that are suitable for isolation and balancing.

**2.03 SNOW MELTING CAPACITY**

- .1 The snow melting system shall be provided in the locations shown on the drawings. The snow melting systems shall provide the heat densities noted on the drawing/ equipment schedules but should not be lower than 205 BTUH/sq.ft (646 W/sq.m) throughout the area where it is installed, and shall heat the slab to a temperature no higher than 39°F (4°C).

**2.04 CONTROL PANEL**

- .1 For each area of snow melting/radiant floor heating, provide a pre-assembled control panel with circulating pump.
- .2 Each panel shall consist of a compact, pre-piped mechanical system with connections to the supply and the return manifolds, in-line circulating pump, check valves, isolation valves, supply and return temperature gauges, pressure bypass valve and a 3-way modulating mixing valve with discharge temperature controls.
- .3 The control panel shall be in a compact insulated foam box ready for field mounting with supplied brackets.
- .4 The control panel shall include integral controls to control the local supply fluid temperature.
- .5 Each panel location shall come complete with slab temperature sensor; and for snow melting systems, outdoor air temperature sensors and snow sensors.
- .6 Sensors shall be installed in appropriate locations within the zone to allow proper of monitoring of slab conditions.
- .7 Sensor shall be installed such that they can be replaced through non-destructive means if a sensor failure should occur.
- .8 Provide sensor termination points within the control panel.
- .9 Provide all required transformers and relays required to monitor, enable and disable the snow melting system through the BAS.

**PART 3 - EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- .1 Install Glycol Snow Melting Systems and components in accordance with the Building Code requirements, Manufacturer's requirements, and the requirements of the Authorities Having Jurisdiction (AHJs).
- .2 Install Glycol Snow Melting Systems in accordance with the Drawing details.

**END OF SECTION**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.
- .2 Comply with requirements of Section 20 05 10 Mechanical General Requirements, and all documents referred to therein.
- .3 Comply with requirements of Section 20 10 10 Basic Materials and Methods, and all documents referred to therein.
- .4 Retain the services of the Base Building Controls vendor to complete the Building Automation System and Controls scope of work; contact information:
  - .1 Ainsworth Inc.  
Contact: Sydney Carr  
Tel: (289) 355-8031  
Email: [Sydney.Carr@ainsworth.com](mailto:Sydney.Carr@ainsworth.com)

1.02 WORK INCLUDED

- .1 Provide all parts and commissioning of the Building Automation System and Controls as indicated in the Specifications, Drawings and other referenced Contract Documents.
- .2 Generally control systems, algorithms and sequence programming shall follow requirements outlined in ASHRAE Guideline 35 - High-Performance Sequences of Operation for HVAC Systems. Any proposed deviations from the Standard shall be reviewed with the Consultant prior to implementation on site.
- .3 Arrange for all the necessary inspections and approvals of built-up and modified control systems and relay panels by the Authorities Having Jurisdiction ("AHJ's"). All electrical equipment, material and its installation shall conform to the current requirements of the AHJ's including:
  - .1 Ontario Electrical Safety Code ("OESC")
  - .2 Ontario Building Code ("OBC")
  - .3 Ontario Fire Code ("OFC")
  - .4 Canadian Standards Association ("CSA")
- .4 Control Work shall be completed by Landlord's/Owner's approved BAS Trade Contractor. The Mechanical Trades shall carry the cost of the Control Work in their Bid Price.
- .5 BAS Trades shall provide all Control Work including control panels, devices, wiring, other ancillaries, programming, and integration and commissioning as required to achieve a complete and fully functioning system operating in accordance with the intent of the design and the sequence of operations.
- .6 Include all necessary services for the successful completion of point-to-point verification of devices, and performance verification of individual devices and composite systems as part of the project Testing, Adjusting and Balancing (TAB) requirements, and project commissioning requirements.
- .7 Align all access doors, unit access locations and piping/duct connections to ensure future serviceability of all system components.

PART 2 - PRODUCTS

2.01 TEMPERATURE SENSORS:

- .1 Resistance Temperature Device (RTD) of precision platinum element with:
  - .1 linear characteristics over sensor range,
  - .2 1000  $\Omega$  Platinum, IEC 751, 385 Alpha, thin film sensor,
  - .3 temperature coefficient of resistance  $0.00385\Omega/\Omega/^\circ\text{C}$ ,
  - .4  $\pm 0.54^\circ\text{F}$  ( $\pm 0.3^\circ\text{C}$ ) @  $32^\circ\text{F}$  ( $0^\circ\text{C}$ ) sensor accuracy,
  - .5 transducing circuit for 0-10,000  $\Omega$  linear output in  $0.9^\circ\text{F}$  ( $0.5^\circ\text{C}$ ) increments at  $60\text{-}80^\circ\text{F}$  ( $16\text{-}26^\circ\text{C}$ ) temperature range compatible with equipment controller
- .2 Resistance Temperature Device (RTD) of precision thin film nickel element with:
  - .1 linear characteristics over sensor range,
  - .2 1000  $\Omega$  Nickel, Class B, DIN 43760 sensor
  - .3 temperature coefficient of resistance  $0.006178\Omega/\Omega/^\circ\text{C}$ ,
  - .4  $\pm 0.72^\circ\text{F}$  ( $\pm 0.4^\circ\text{C}$ ) @  $32^\circ\text{F}$  ( $0^\circ\text{C}$ ) sensor accuracy,
  - .5 transducing circuit for 0-10,000  $\Omega$  linear output in  $0.9^\circ\text{F}$  ( $0.5^\circ\text{C}$ ) increments at  $60\text{-}80^\circ\text{F}$  ( $16\text{-}26^\circ\text{C}$ ) temperature range compatible with equipment controller
- .3 Thermistor element type with:
  - .1 non-linear, curve matched over sensor range,
  - .2 10,000  $\Omega$  at  $77^\circ\text{F}$  ( $25^\circ\text{C}$ ), NTC Type III,  $\pm 0.36^\circ\text{F}$  ( $\pm 0.2^\circ\text{C}$ ) sensor
  - .3  $\pm 0.36^\circ\text{F}$  ( $\pm 0.2^\circ\text{C}$ ) sensor accuracy over  $32^\circ\text{F}$  to  $158^\circ\text{F}$  ( $0^\circ\text{C}$  to  $70^\circ\text{C}$ )
  - .4 long term stability of  $0.045^\circ\text{F}$  ( $0.025^\circ\text{C}$ ) drift per year
  - .5 transducing circuit for 0-10,000  $\Omega$  linear output in  $0.9^\circ\text{F}$  ( $0.5^\circ\text{C}$ ) increments at  $60\text{-}80^\circ\text{F}$  ( $16\text{-}26^\circ\text{C}$ ) temperature range compatible with equipment controller
- .4 Provide temperature sensors, with accuracy as noted, in the following applications:
  - .1 chilled water, chilled glycol solution, outdoor air temperature:  $\pm 0.45^\circ\text{F}$  ( $\pm 0.2^\circ\text{C}$ );
  - .2 heating water, heating glycol solution, condenser water, duct dry-bulb temperature points:  $\pm 0.9^\circ\text{F}$  ( $0.3^\circ\text{C}$ );
  - .3 room dry-bulb temperature:  $\pm 1.35^\circ\text{F}$  ( $\pm 0.4^\circ\text{C}$ );
  - .4 algorithm(s) for measuring dewpoint temperature, wet-bulb temperature, and enthalpy:  $\pm 0.45^\circ\text{F}$  ( $\pm 0.2^\circ\text{C}$ );
  - .5 algorithm(s) used as part of metering applications:  $\pm 0.45^\circ\text{F}$  ( $\pm 0.2^\circ\text{C}$ );
- .5 Adjustable room/ space dry-bulb temperature sensors with display:
  - .1 For measurement and adjustment of space dry-bulb temperatures in rooms



- .2 Field configure for either °C or °F display;
  - .3 sensor ambient operating temperature range from 0 to 50°C (32 to 122°F), 5 to 95 %RH non-condensing,
  - .4 three digit LED digital temperature display with 0.5° display resolution
  - .5 Up / Down keypad for ten (10) step temperature setpoint adjustment between 20°C to 25°C (68°F to 78°F);
  - .6 Dry contact occupancy override feature;
  - .7 minimum / maximum limit set point values adjustable from BAS operator interface and Controller
  - .8 surface mounted plastic mono-chromatic guard with surface mounting plate and wall anchors; guard secured to mounting plate by screws.
  - .9 When used with multi-speed terminal device such as a fan coil unit or cabinet heater, provide five (5) position fan speed switch - Off, Auto, Low, Medium, High – using resistive signal reference 0, 2, 4, 6, 8 KΩ respectively.
- .6 Duct mount probe type dry-bulb temperature sensors:
- .1 sensor ambient operating temperature range from -40°C to 60°C (-40°F to 140°F), non-condensing 5 to 95% RH
  - .2 6.35mm (0.25") diameter, 304 series stainless steel probe
  - .3 metal mounting plate
- .7 Duct averaging element type dry-bulb temperature sensors:
- .1 for measurement in ducts of cross section greater than 4 sq.ft (0.4 sq.m)
  - .2 sensor ambient operating temperature range from -40°F to 140°F (-40°C to 60°C), non-condensing 5 to 95% RH
  - .3 flexible multi-point duct averaging temperature sensor utilizes several precision sensors spaced at equal distances along probe length;
  - .4 0.315" (7.94 mm) diameter probe, soft copper construction;
  - .5 probe minimum length of 4m (13 ft.);
  - .6 probe field formable to minimum radius of 4" (100 mm) at any point along probe length (within 8" (200 mm) of connector box excepted), without degradation of performance;
- .8 Thermowell immersion temperature sensors:
- .1 insertion elements for single point temperature measurement of fluid
  - .2 0.236" (6 mm) diameter, 304 series stainless steel probe
  - .3 -40 to 122°F (-40 to 50°C), 5 to 95 %RH non-condensing
  - .4 316 stainless steel thermowells, complete with thermal conductive compound added inside the thermowell for optimum thermal transfer.

- .5 Probe and therowell length minimum 30% of pipe size;
- .6 Spring loaded construction with compression fitting for ¾" (20mm) well mounting

2.02 AUTOMATIC CONTROL VALVES:

- .1 Provide bubbletight shutoff for the assemblies' full-rated pressure in two-way and three-way arrangements for two-position (Open/Closed), and modulating control applications.
- .2 Properly sized and selected by the manufacturer in accordance with load requirements and characteristics of the systems to which they are applied.
- .3 Where control valve/Cv sizing has not been noted, size control valves as follows:
  - .1 two-way modulating control valves: 2.5 psi (18kPa) water pressure drop;
  - .2 three-way modulating control valves: 5 psi (35kPa) water pressure drop.
- .4 Modulating applications: provide valves with throttling plugs for linear lift-flow ratio.
- .5 Where butterfly type valves are used in a 3-port arrangement, mount valves on a common tee and use one actuator only.
- .6 Bronze body **globe style control valves**, sizes ½" to 2" (12mm to 50mm):
  - .1 Seat style: single seat, metal-to-metal
  - .2 Action: Normally Closed (NC), Normally Open (NO) in accordance with the Sequence of Operations
  - .3 Stem travel (Stroke): ¾" (20 mm)
  - .4 Valve body: ANSI Class 250
  - .5 Valve body: UNS CA 844 Bronze
  - .6 Trim: Stainless Steel
  - .7 Stem: Stainless Steel ASTM A582 Type 303
  - .8 Packing: Normal duty: EPDM O-rings; Steam: PTFE V-rings and EPDM O-ring
  - .9 Maximum Temperature Range: Normal Duty Packing: 20°F to 250°F (-7°C to 120°C); Steam Packing: 337°F (170°C)
  - .10 Differential pressure for modulating service: 50 psi (345 kPa)
  - .11 Rangeability: >100:1
  - .12 Leakage Rate: Class IV (0.01% of Cv)
- .7 Cast iron body **globe style control valves**, sizes 2½" to 6" (65mm to 150mm):
  - .1 Seat style: single seat
  - .2 Action: Normally Closed (NC), Normally Open (NO) in accordance with the Sequence of Operations
  - .3 Stem travel (Stroke): ¾" (20 mm) for valve sizes 2½" to 3" (65mm to 75mm); 1½" (40 mm) for valve sizes 4" to 6" (100mm to 150mm);
  - .4 Valve body: ANSI Class 125 or 250
  - .5 Valve body: Cast Iron ASTM A126 Class B
  - .6 Trim: Stainless Steel
  - .7 Stem: Stainless Steel ASTM A582 Type 303
  - .8 Packing: Normal duty: EPDM O-rings; Steam: PTFE V-rings and EPDM O-ring
  - .9 Maximum Temperature Range: Normal Duty Packing: 20°F to 250°F (-7°C to 120°C); Steam Packing: 337°F (170°C)

- .10 Differential pressure for modulating service: 50 psi (345 kPa)
  - .11 Rangeability: >100:1
  - .12 Leakage Rate: Class IV (0.01% of Cv)
- .8 Resilient seat **butterfly control valves**, sizes 2" to 12" (50mm to 300mm):
- .1 Body: ASTM A126 Class A Cast Iron
  - .2 Disc: 316 Stainless Steel
  - .3 Stem: 416 Stainless Steel
  - .4 Seat: High purity, peroxide-cured, high temperature EPDM
  - .5 Bearing: Heavy Duty Acetal
  - .6 Packing: NBR
  - .7 Temperatures: -20°F to 250°F (-28°C to 121°C) continuous
  - .8 Close-off Rating: 175 psi (1200 kPa) full cut disc
- .9 Resilient seat **butterfly control valves**, sizes 14" to 24" (350mm to 600mm):
- .1 Body: ASTM A126 Class A Cast Iron
  - .2 Disc: Electroless Nickel Plated Ductile Iron
  - .3 Stem: 416 Stainless Steel
  - .4 Seat: High purity, peroxide-cured, high temperature EPDM
  - .5 Bearing: Heavy Duty Acetal
  - .6 Packing: NBR
  - .7 Temperatures: -20°F to 250°F (-28°C to 121°C) continuous
  - .8 Close-off Ratings: 150 psi (1035 kPa) full cut disc

### 2.03 AUTOMATIC CONTROL VALVE ACTUATORS:

- .1 24 VAC electric/electronic motor driven type actuator coupled to control valves with linkage,
- .2 Actuator construction shall be capable of withstanding high shock and vibration without operations failure, and be complete with:
  - .1 electronic interface control board;
  - .2 solid state drive;
  - .3 reversible motor;
  - .4 oil immersed gear train,
- .3 Actuator enclosure:
  - .1 general purpose, drip proof NEMA 3R die-cast housing with corrosion resistant hard-anodized aluminum or steel material cover for indoor applications;
  - .2 watertight NEMA 4 enclosure for outdoor use suitable for operation down to -35°C,
- .4 Actuator shall provide two position, or proportional control action as required by the intended application,
- .5 Actuator shall accept control signals compatible with the BAS analog or digital output of 0 to 10VDC, or 0 to 20mA as appropriate,
- .6 Actuator shall operate the valve from the fully closed to the fully open position and vice versa in less than two (2) minutes,

- .7 Actuator shall modulate the valve stem position in a linear relation to the control signal.
- .8 Control valve stem position shall be adjustable in increments of one (1%) percent or less of full stem travel,
- .9 Actuator shall have visual mechanical position indication, showing valve position,
- .10 Actuator shall have provision for manual positioning of valve when actuator is not powered,
- .11 Electronic overload or digital rotation sensing circuitry shall protect control valve actuator through entire range of rotation,
- .12 Provide span and zero travel adjustment,
- .13 Control valves larger than ¾" (20mm) shall have integral position potentiometer or 0 to 10 VDC feedback signals to indicate the stem position of the valve at the BAS, all valve actuators shall include integral end position indicators,
- .14 Water and Glycol Solution control valve actuators selected for close-off pressure ratings as follows;
  - .1 two-way modulating or two position service; 150% of pump shut off head.
  - .2 three-way modulating service; 300% of pressure differential between ports A and B at design flow or 100% of pump shut off head, whichever is greater.
  - .3 shut off head to be based on maximum RPM when pump is fitted with VFD.
- .15 Actuator shall include spring return mechanism to return valve to "normal" position on power failure or isolation from control signal as follows:
  - .1 Heating water and glycol zone valves; normally open.
  - .2 Heating coil valves in AHU; normally open.
  - .3 Chilled water control valves; normally closed.
  - .4 Chilled water differential pressure by-pass control valves; normally open.
- .16 Hot water and glycol differential pressure by-pass control valves; normally closed.

#### 2.04 SEQUENCE OF OPERATION:

- .1 Refer to the Drawings for Sequence of Operations.

### PART 3 - EXECUTION

#### 3.01 GENERAL REQUIREMENTS

- .1 Install Building Automation System and Controls in accordance with the Building Code requirements, Manufacturer's requirements, and the requirements of the Authorities Having Jurisdiction (AHJs).

#### 3.02 CONTROL WIRING AND DEVICES:

- .1 All control wiring and devices shall be provided by the BAS Trades.

- .2 Space/room temperature and humidity sensors shall be located at same mounting height as light switches. Final mounting height and location of space sensors to be coordinated on site with Interior Designer.
- .3 Add and relocate space/room temperature and humidity sensors and revise control wiring as indicated on drawing.
- .4 space/room temperature and humidity sensors to be located a minimum 12" (300mm) away from, but never above, dimmer switches.
- .5 Install space/room temperature and humidity sensors on concealed junction boxes supported by wall framing.
- .6 New sensors must be submitted for approval to the consultant.

END OF SECTION

Job Name:

Schedule Reference:

Date:



### GENERAL FEATURES

- Dual set point functionality (\*2)
- Compact, lightweight, shiny-white, flat-panel design
- Multiple fan-speed settings
- Intake grille filter is easily removed for cleaning -
- Wireless receiver on board
- Quiet operation
- IT Terminal Plug

### ACCESSORIES

- External Heater Adaptor - (PAC-YU25HT)
- Wireless Remote Controller - (PAR-FL32MA-E)

Model		PKFY-P30NKMU-E2		
Power source		1-phase 208/230V 60Hz		
Cooling capacity *1 (Nominal) *1	BTU/h	30,000		
	kW	8.8		
	Power input	kW	0.07	
	Current input	A	0.5	
Heating capacity *2 (Nominal) *2	BTU/h	34,000		
	kW	10		
	Power input	kW	0.07	
	Current input	A	0.5	
Minimum Circuit Ampacity *		A	0.63	
External finish		Plastic, MUNSELL (1.0Y 9.2/0.2)		
External dimension HxWxD		in.	14-3/8 x 46-1/16 x 11-5/8	
		mm	365x1170x295	
Net weight		lbs (kg)	46(21)	
Heat exchanger		Cross fin (Aluminum fin and copper tube)		
FAN	Type x Quantity		Line flow fan x 1	
	External static press.	in.WG	0	
		Pa	0	
	Motor Type		DC motor	
	Motor output		kW	0.056
	Driving mechanism		Direct-drive	
	Air flow rate	cfm	710-920	
m3/min		20-26		
Sound pressure level (measured in anechoic room)		dB <A>	43-49	
Insulation material		Polyethylene sheet		
Air filter		PP honeycomb		
Protection device		Fuse		
Refrigerant control device		LEV		
Connectable outdoor unit		R410A CITY MULTI		
Diameter of refrigerant pipe	Liquid (R410A)	in.(mm)	3/8(9.52) Flare	
	Gas (R410A)	in.(mm)	5/8(15.88) Flare	
Field drain pipe size		in.(mm)	I.D. 5/8(16)	

**NOTE:**

1. Mitsubishi Electric Sales Canada Inc. (MESCA) supports the use of only MESCA supplied and approved components and accessories for proper functioning of the unit(s). Use of non - MESCA supported components and accessories will affect warranty coverage. MESCA recommends (A) consideration of all applicable design and application parameters and requirements specific to any project; and (B) implementation of any countermeasures needed to address those parameters and requirements, wherever applicable.  
 \*2. All components of the system must be compatible. For more details on system control compatibility, please refer to Technical Bulletin 100-151 available on our website.

NOTE: Items denoted in this submittal by an asterisk (\*) are provided as specific instances or examples of system compatibility, and are not intended to represent a complete or exhaustive list of compatibility requirements.  
 3. Should any person change this document in any manner whatsoever without MESCA's written permission, the document shall be of no force and effect and any change shall be deemed to be a representation and warranty made by that person and not MESCA. That person, and not MESCA, shall assume full responsibility for the consequences of such changes. MESCA assumes no responsibility for any consequences in such cases.

Note :	*1 Nominal cooling conditions	*2 Nominal heating conditions
Indoor :	80degF D.B. / 67degF W.B. (26.7degC D.B. / 19.4degC W.B.)	70degF D.B. (21.0degC D.B.)
Outdoor :	95degF D.B. (35degC D.B.)	47degF D.B. / 43degF W.B. (8.3degC D.B. / 6.1degC W.B.)
Pipe length :	25 ft. (7.6 m)	25 ft. (7.6 m)
Level difference :	0 ft. (0 m)	0 ft. (0 m)

Note:  
 Ventilation air to be introduced independent of or in series with VRF indoor units.  
 Please refer to local codes for the required ventilation rates specific to the application.

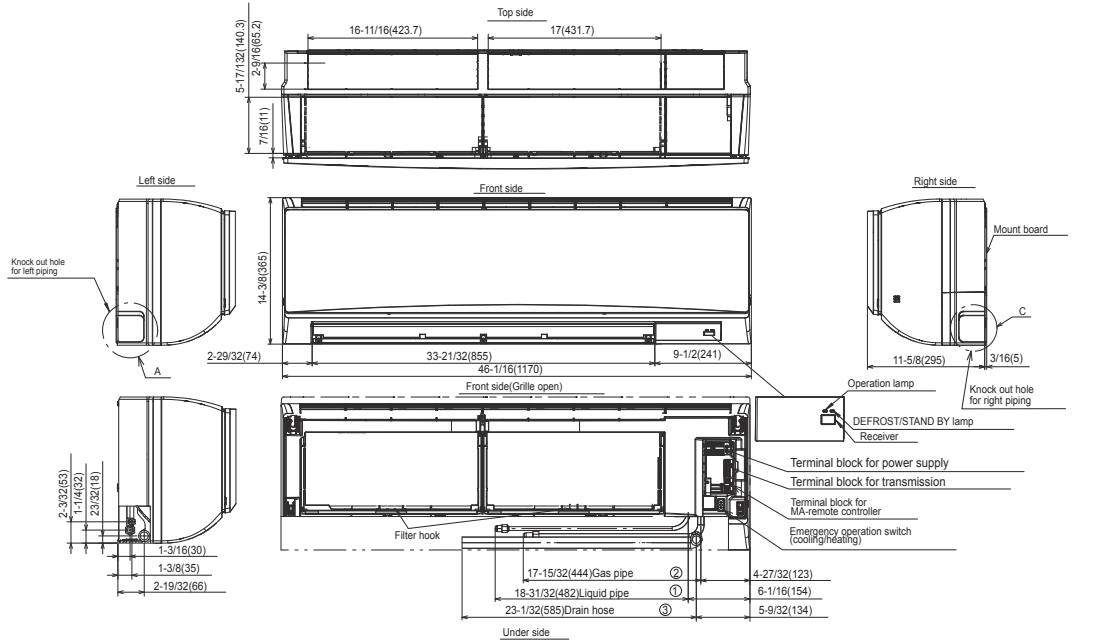
Notes:

Specifications are subject to change without notice.

\*All electrical work shall comply with National (CEC) and local codes and regulations.

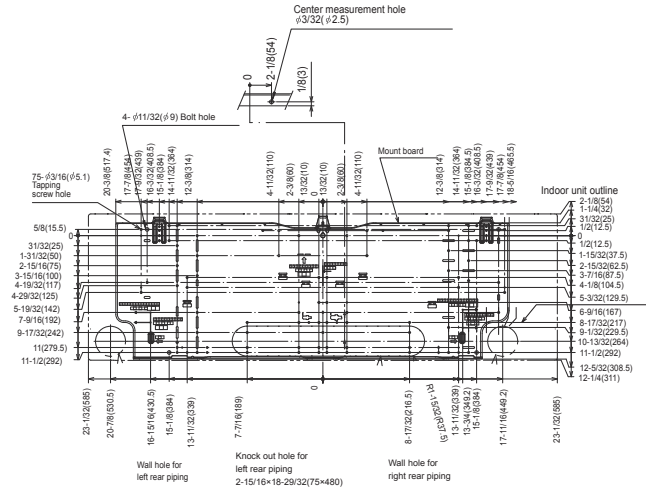
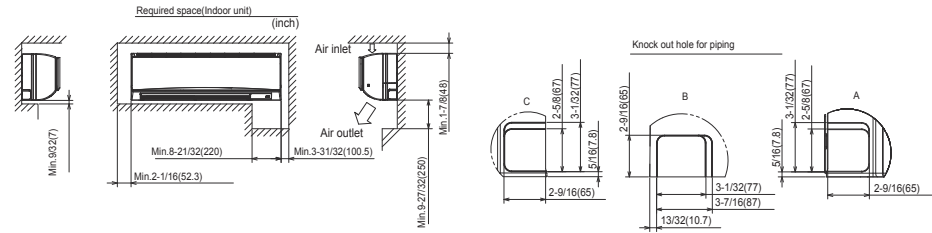
# Model: PKFY-P30NKMU-E2-TH – DIMENSIONS

Unit: inch(mm)



Sleeve (purchased locally)	Through hole
φ2-15/16 (φ75)	φ2-15/16~φ3-5/32 (φ75~φ80)

Piping connection department	
① Liquid pipe	Refrigerant pipe: 3/8 O.D.(φ9.52) Flared connection: 3/8F
② Gas pipe	Refrigerant pipe: 5/8 O.D.(φ15.88) Flared connection: 5/8F
③ Drain hose	5/8(φ16) I.D.



Should this document be altered or changed without MESCA's permission, it becomes null and void. MESCA assumes no responsibility for any consequences in such cases.



Job Name:

Schedule Reference:

Date:



### GENERAL FEATURES

- Dual set point functionality (\*1)
- Adjustable airflow angle
- Four-speed fan setting
- Ventilation air intake supported
- Filter: long life included
- IT Terminal Plug

### OPTIONS

- Medium-efficiency Filter (MERV 8).....PAC-SH90KF-E
- i-see Sensor.....PAC-SH91MK-E
- Wireless Remote Controller Receiver Kit.....PAR-SL93B-E
- Wireless Remote Controller Receiver Kit with i-See Sensor.....PAR-SA92MW-E
- Drain Pump Kit.....PAC-SH84DM-E
- External Heater Adapter..... PAC-YU25HT

**NOTE:**

1. Mitsubishi Electric Sales Canada Inc. (MESCA) supports the use of only MESCA supplied and approved components and accessories for proper functioning of the unit(s). Use of non - MESCA supported components and accessories will affect warranty coverage. MESCA recommends (A) consideration of all applicable design and application parameters and requirements specific to any project; and (B) implementation of any countermeasures needed to address those parameters and requirements, including the provision of antifreeze solution in water based systems used in conjunction with ducted indoor units.
2. All components of the system must be compatible. For more details on system control compatibility, please refer to Technical Bulletin 100-151 available on our website.
3. Should any person change this document in any manner whatsoever without MESCA's written permission, the document shall be of no force and effect and any change shall be deemed to be a representation and warranty made by that person and not MESCA. That person, and not MESCA, shall assume full responsibility for the consequences of such changes. MESCA assumes no responsibility for any consequences in such cases.

### SPECIFICATIONS

**Capacity\***

Cooling.....36,000 Btu/h  
 Heating.....40,000 Btu/h

**Power**

Power Source.....208 / 230V, 1-phase, 60Hz

**Power Consumption**

Cooling.....0.11 kW  
 Heating.....0.11 kW

**Current**

Cooling.....0.97 A  
 Heating.....0.97 A

Minimum Circuit Ampacity (MCA \*).....1.22 A

Maximum Overcurrent Protection (MOCP) Fuse.....15 A

**\*All electrical work shall comply with National (CEC) and local codes and regulations.**

**External Finish**.....Polyester painted steel sheet  
 Munsell No. 6.4Y 8.9 / 0.4

**External Dimensions**

Inches.....9-1/16 H x 63 W x 26-3/4 D  
 mm.....230 H x 1,600 W x 680 D

**Net Weight**

Unit.....84 lbs. / 38 kg

**Coil Type**.....Cross Fin  
 (Aluminum Plate Fin and Copper Tube)

**Fan**

Type x Quantity.....Sirocco Fan x 4  
 Airflow Rate (Low-Mid1-Mid2-High)....742 - 847 - 953 - 1,095 CFM  
 Motor Type.....Direct-driven DC Motor

**Air Filter**.....Polypropylene Honeycomb

**Refrigerant Piping Dimensions (R410A)**

Liquid (High Pressure).....3/8" / 9.52 mm (Flare)  
 Gas (Low Pressure).....5/8" / 15.88 mm (Flare)

**Drainpipe Dimension**.....O.D. 1" / 26 mm

**Sound Pressure Levels**

Low-Mid1-Mid2-High.....36 - 39 - 42 - 44 dB(A)

\* Cooling / Heating capacity indicated at the maximum value at operation under the following conditions:

Cooling | Indoor: 80° F (27° C) DB / 67°F (19° C) WB,  
 Cooling | Outdoor: 95° F (35° C) DB  
 Heating | Indoor: 70° F (21° C) DB,  
 Heating | Outdoor: 47°F (8° C) DB / 43° F (6° C) WB

**Note:**

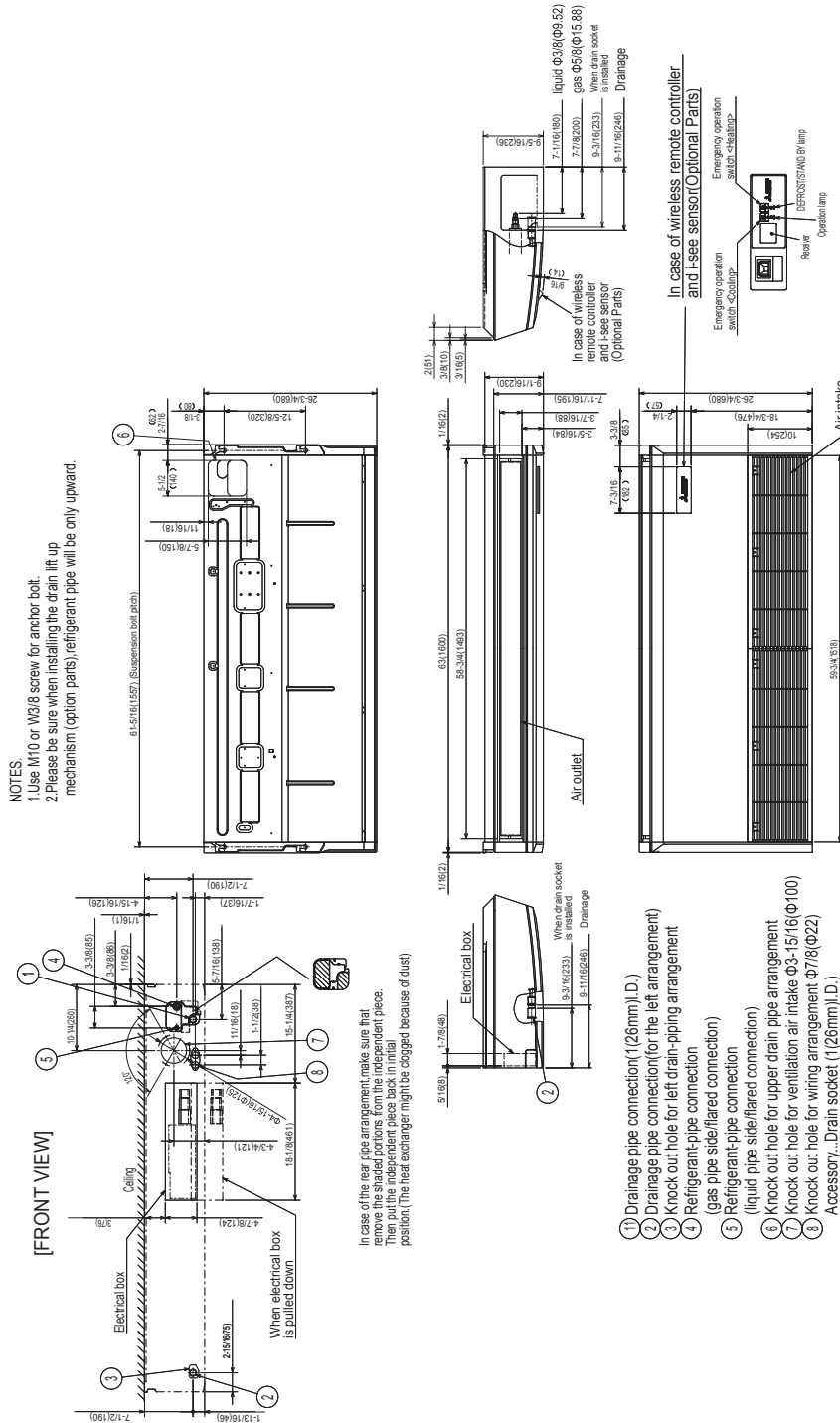
Ventilation air to be introduced independent of or in series with VRF indoor units. Please refer to local codes for the required ventilation rates specific to the application.

Notes:



# Model: PCFY-P36NKMU-E – DIMENSIONS

Unit : in(mm)



Form # SB\_PCFY-P36NKMU-E\_202002  
 Specifications are subject to change without notice.  
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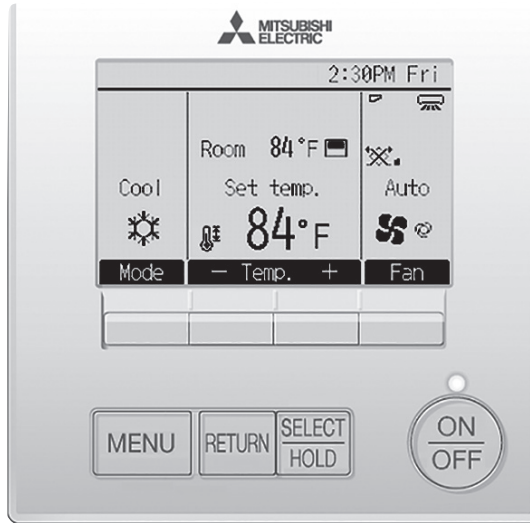


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Job Name:

Schedule Reference:

Date:



Dual Set Point

## Functions

### 1. Operation/DisplOperation/Display ○: Each group X: Not available

Item	Description	Setting	Display
ON/OFF	Switches between ON and OFF.	○	○
Operation mode switching	Switches between Cool/Dry/Fan/Auto/Setback/Heat.	○	○
Hold	Switches between enable and disable the Hold function. If the Hold function is enable, the following functions will be prohibited. ON/OFF timer/Schedule (Weekly timer) /Auto return/ Auto-OFF timer	○	○
Temperature setting	Changes the set temperature. * Set temperature range varies depending on the indoor unit model.	○	○
Fan speed setting	Changes fan speed. * Available fan speeds vary depending on the model.	○	○
Air flow direction setting	Changes airflow direction. * Available airflow directions vary depending on the model.	○	○
Louver setting	Switches between louver ON/OFF.	○	○
Ventilation equipment control	Interlocked setting and interlocked operation setting with City Multi Lossnay units can be performed. The Stop/Low/High settings of the ventilation equipment can be controlled.	○	○
Auto descending panel *1	Raises and lowers the automatic elevating panel.	○	○
Main display mode setting	The Main display can be displayed in two different modes: "Full" and "Basic."	○	○
B&W inversion	The colors of the display can be inverted, turning white background to black and black characters to white.	○	○
Clock *2	Date (year/month/day) and time (hour/minute) can be set. The set time as well as the day of the week will be displayed on the Main display. It is also possible to set not to display the time on the Main display. The clock can be displayed in 12-hour format (AM/PM before or after the time) and 24-hour format.	○	○
Daylight saving time	The start/end time for daylight saving time can be set. The daylight saving time function will be activated based on the setting contents.	○	○
Room temp. display	The room temperature display can be enabled or disabled.	—	○
Error information	When an error occurs, an error code and the unit address appear. The air-conditioning unit model, serial number, and contact number can be set to appear when an error occurs. (The above information needs to be entered in advance.) * An error code may not appear depending on the error.	—	○
Filter information	A filter sign will appear when it is time to clean the filter.	—	○
Remote controller information	The version of the remote controller can be checked.	—	○

### 3. Restriction settings ○: Each group X: Not available

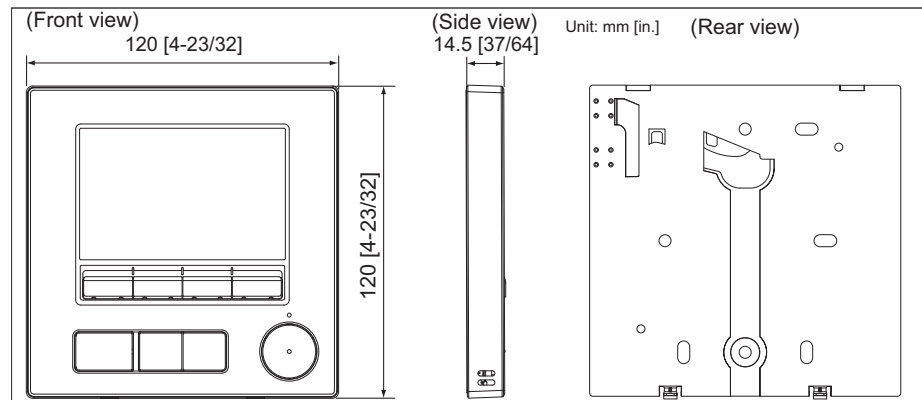
Item	Description	Setting	Display
Allows/disallows local operation	The following operation can be prohibited by applying certain settings on the centralized controller: ON/OFF, operation mode, set temperature, filter sign reset, air direction, fan speed and timer. * While an operation is prohibited, the operation icon lights up (only on the Main display in the "Full" mode).	X	○
Operation lock	The following operations can be prohibited: "Location," "On/Off," "Mode," "Set temp.," "Menu," "Fan," "Louver," "Vane," or "Hold."	○	○
Temperature range restriction	The room temperature range for each operation mode can be restricted.	○	○
Auto return	The units operate at the preset temperature after a designated period. (Time can be set to a value from 30 to 120 minutes in 10-minute increments.) * Not valid when the temperature setting range is restricted.	○	X
Password	Administrator password (required for schedule setting etc.) and Maintenance password (required for test run and function setting etc.) can be set.	○	X

### 4. Miscellaneous items ○: Each group X: Not available

Item	Description	Setting	Display
Language Selection	Select the display language from the following 3 languages. English, French, Spanish	○	○
Brightness Contrast	The brightness of the LCD can be adjusted. The contrast of the LCD can be adjusted.	○	○
Manual vane Angle *1	Fixes the vane position for each air outlet.	○	X
Service *1	Contains Test run, Function setting, Request code, and Error history.	○	○
3D i-see Sensor	Settings for 3D i-see Sensor can be made.	○	○

\*1 This function is active only for the units that support the function.  
\*2 The clock is accurate within 45 seconds per month (at the temperature of 77°F [25°C]). The clock is backed up for 3 days.

## External dimension

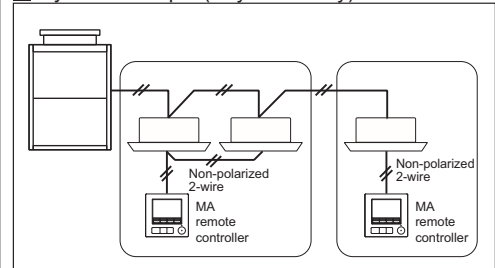


● Backlit LCD ● Can be set and shown by 1°F/0.5°C.

### 2. Schedule and timer setting ○: Each group X: Not available

Item	Description	Setting	Display
Timer	ON/OFF timer Turns ON and OFF daily at a set time. * Time can be set in 5-minute increments. * It is also possible to set the ON time only or the OFF time only. Auto-OFF timer Turns off the unit after a certain period of operation. * Operation time can be set to a value from 30 to 240 minutes in 10-minute increments.	○	○
Weekly timer	Weekly ON/OFF times and set temperatures can be set. * Time can be set in 5-minute increments. Up to 8 schedule patterns can be set per day of the week. * Not valid when the ON/OFF timer is set.	○	○

### System example (City Multi Only)



\*When a PAR-40MAAU is connected to a group, no other MA remote controllers can be connected to the same group.

Job Name:	Location:		
Schedule Reference:	Submitted By:		
Submitted To:	Reference:	Approval:	Construction:
Engineer:	Date:	Application:	



Images provided for reference purposes only

- Designed specifically for use with CITY MULTI outdoor units
- Choice of three fan speeds for optimum comfort
- Built-in condensate lift; lifts to 27-9/16" (700mm)
- 9-7/8" (250mm) high for low ceiling heights
- Highly efficient DC motor
- Dual setpoint functionality <sup>7</sup>
- IT Terminal (CN105)

**Rated Capacity:** (Cooling / Heating capacity indicated at the maximum value at operation under the following conditions Note: <sup>1,2</sup>)

Cooling <sup>1</sup>	Btu/h	36,000
Heating <sup>2</sup>	Btu/h	40,000

**Specifications:**

Power Supply		208/230V, 1Ph, 60Hz	
Minimum Circuit Ampacity (MCA) <sup>3</sup>	A	4.25	
Maximum Fuse/Breaker Size	A	15	
Fan Type x Quantity		Sirocco fan x 3	
Motor Type x Quantity		DC motor x 1	
Airflow Rate	CFM	883 - 1,077 - 1,271	
External Static Pressure (Selectable)	In. WG	<0.14> - 0.20 - <0.28> - <0.40> - <0.60>	
Sound Pressure Level (measured in anechoic room)	dB(A)	35-39-43	
Drain Pipe Size	In. (mm)	O.D. 1-1/4 (32)	
External Finish		Galvanized steel plate	
Coil Type		Cross fin (Aluminum fin and copper tube)	
Air Filter		PP honeycomb fabric.	
Unit Dimensions	H: In. (mm)	9-7/8 (250)	
	W: In. (mm)	55-1/8 (1,400)	
	D: In. (mm)	28-7/8 (732)	
Net Weight	Lbs. (kg)	84 (38)	
Refrigerant Pipe Diameter (gas)	(Braze)	In. (mm)	5/8 (15.88)
Refrigerant Pipe Diameter (liquid)	(Braze)	In. (mm)	3/8 (9.52)

**Model No. Description: (Optional Accessories)**

PAC-YU25HT	External Heater Adapter
FBM2-4-A	Filter Box and Filter(s) (MERV13)
PAC-KE94TB-E	Filter Box

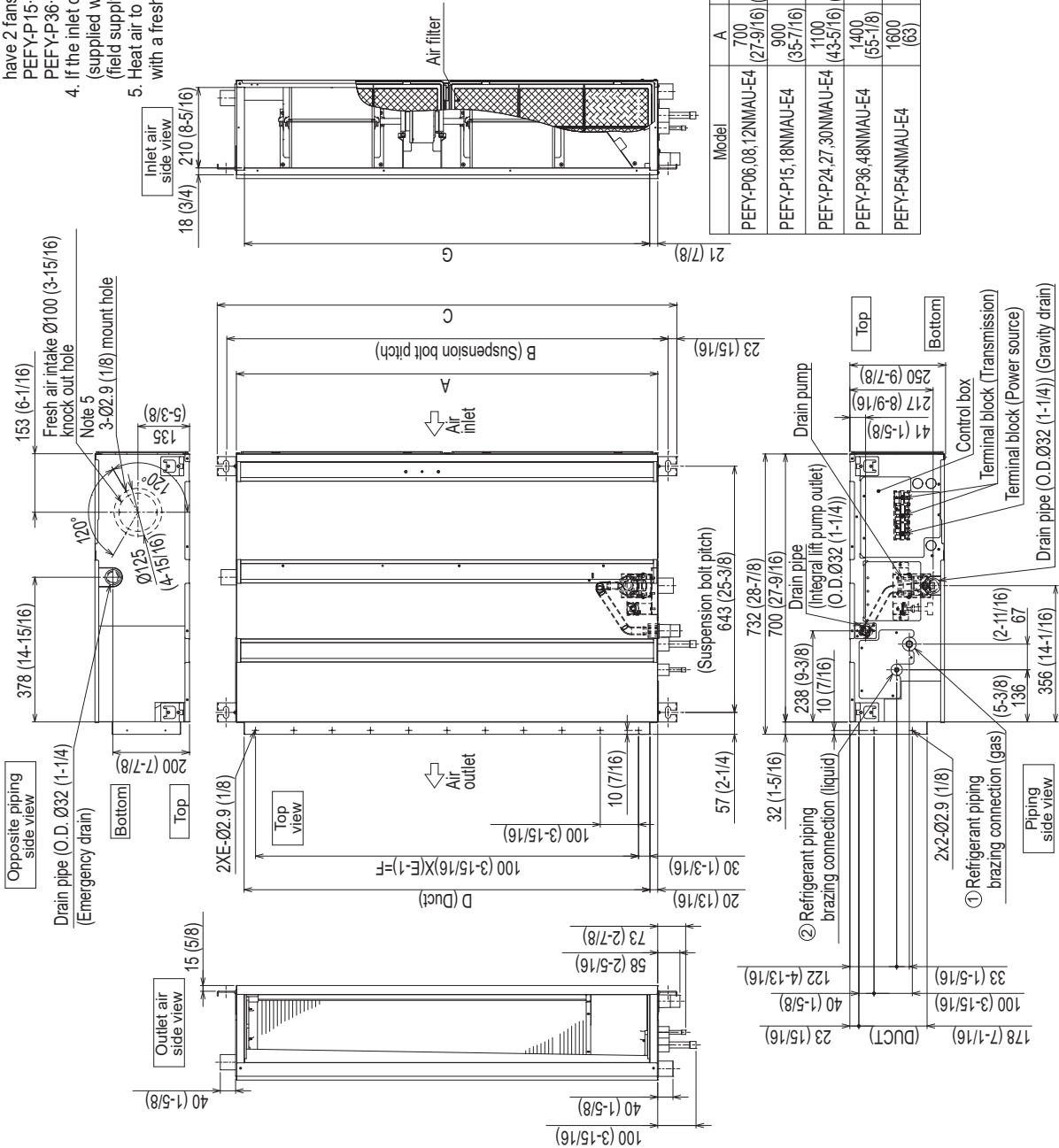
Notes:

**Note:**

- Cooling (Indoor // Outdoor) 80°F (26.7°C) DB, 67°F (19.4°C) WB // 95°F (35°C) DB
- Heating (Indoor // Outdoor) 70°F (21.1°C) DB // 47°F (8.3°C) DB, 43°F (6.1°C) WB
- All electrical work shall comply with National (CEC) and local codes and regulations.
- Ventilation air to be introduced independent of or in series with VRF indoor units. Please refer to local codes for the required ventilation rates specific to the application.
- Applications should be restricted to **comfort heating and cooling only**; process/equipment heating and cooling applications are not recommended.
- Mitsubishi Electric Sales Canada Inc. (MESCA) supports the use of only MESCA supplied and approved components and accessories for proper functioning of the unit(s). **Always consult relevant technical product documentation at [mitsubishitechinfo.ca](http://mitsubishitechinfo.ca), your local distributor or MESCA BC sales office as applicable.** Use of non - MESCA supported components and accessories will affect warranty coverage. MESCA recommends (A) consideration of all applicable design and application parameters and requirements specific to any project; and (B) implementation of any countermeasures needed to address those parameters and requirements, including the provision of antifreeze solution in water based systems used in conjunction with ducted indoor units.
- All components of the system must be compatible. For more details on system control compatibility, please refer to Technical Bulletin 100-151 available on our website.
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**Indoor Unit Outline and Dimensions:**

- Note 1. Use an M10 screw for the suspension bolt (field supply).  
 2. Keep the service space for maintenance at the bottom.  
 3. This drawing is for PEFY-P24-27-30NMAU-E4 models, which have 2 fans. PEFY-P06-08-12NMAU-E4 models have 1 fan. PEFY-P15-18NMAU-E4 models have 2 fans. PEFY-P36-48-54NMAU-E4 models have 3 fans.  
 4. If the inlet duct is used, remove the air filter (supplied with the unit), then install the filter (field supply) at the suction side.  
 5. Heat air to 0°C (32°F) or higher when taking fresh air with a fresh air intake.

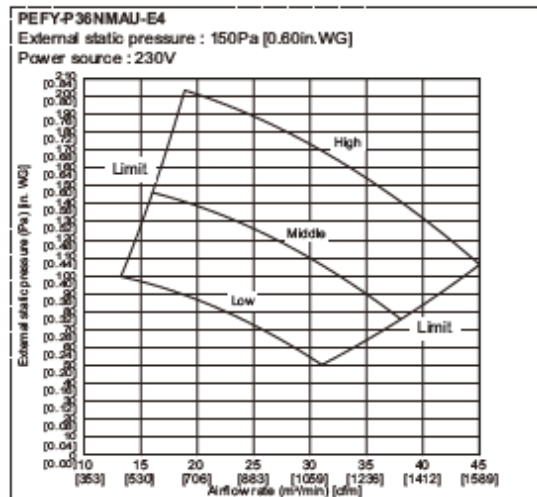
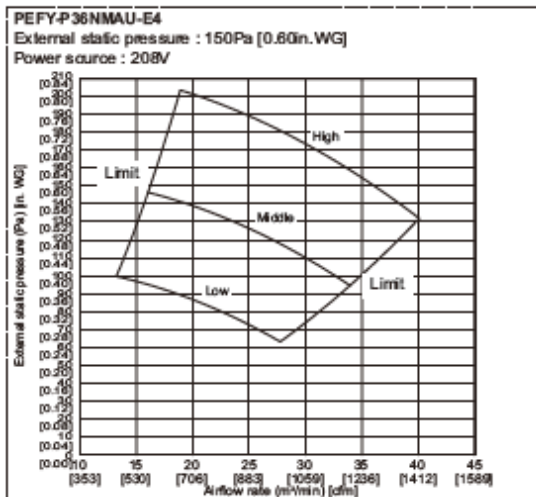
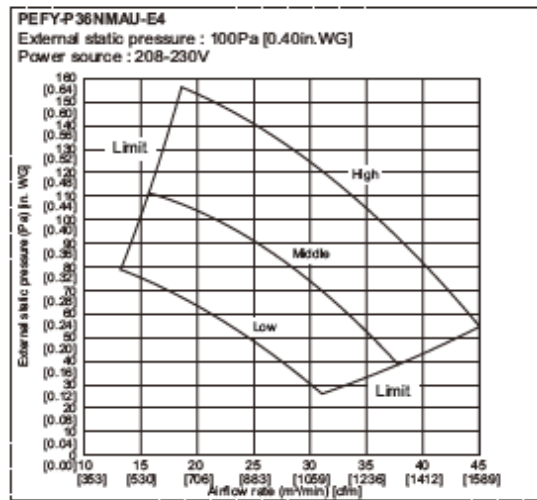
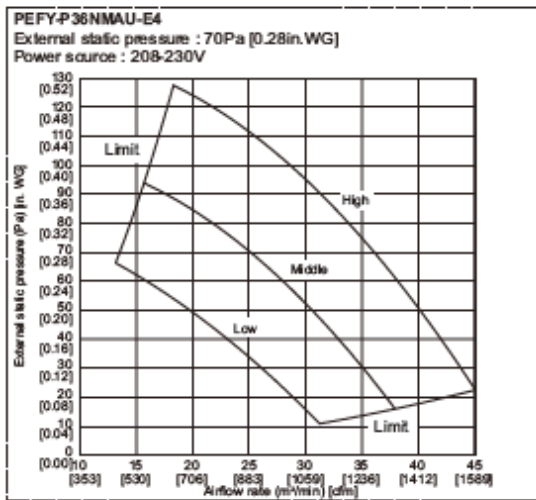
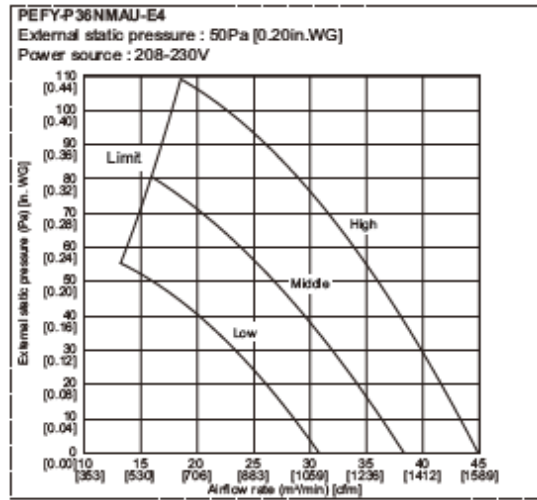
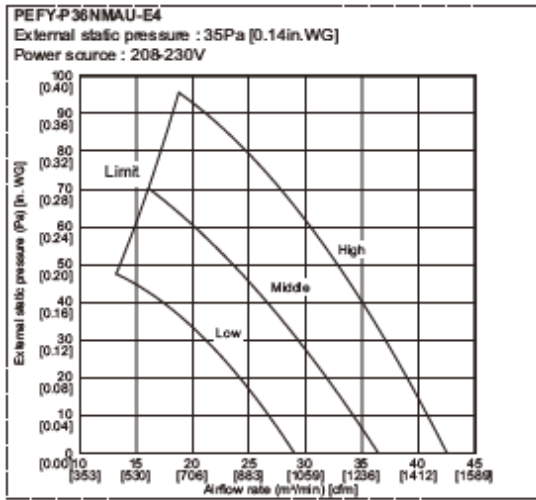


Model	Unit:mm(in.)	
	① Gas pipe	② Liquid pi
PEFY-P06,08,12NMAU-E4	Ø12.7 (1/2)	Ø6.35 (1/4)
PEFY-P15,18NMAU-E4		
PEFY-P24,27,30NMAU-E4	Ø15.88 (5/8)	Ø9.52 (3/8)
PEFY-P36,48NMAU-E4		
PEFY-P54NMAU-E4		

Model	Unit:mm(in.)						
	A	B	C	D	E	F	G
PEFY-P06,08,12NMAU-E4	700 (27-9/16)	754 (29-11/16)	800 (31-1/2)	660 (26)	7	600 (23-5/8)	658 (25-15/16)
PEFY-P15,18NMAU-E4	900 (35-7/16)	954 (37-9/16)	1000 (39-3/8)	860 (33-7/8)	9	800 (31-1/2)	858 (33-13/16)
PEFY-P24,27,30NMAU-E4	1100 (43-5/16)	1154 (45-7/16)	1200 (47-1/4)	1060 (41-3/4)	11	1000 (39-3/8)	1058 (41-11/16)
PEFY-P36,48NMAU-E4	1400 (55-1/8)	1454 (57-1/4)	1500 (59-1/8)	1360 (53-9/16)	14	1300 (51-3/8)	1358 (53-1/2)
PEFY-P54NMAU-E4	1600 (63)	1654 (65-1/8)	1700 (66-15/16)	1560 (61-7/16)	16	1500 (59-1/8)	1558 (61-3/8)

Unit : mm (in.)

**Fan Characteristics Curves:**



Note: MERV13 filter Box & Filter is not reflected in these displayed curves, reference Form # SB\_FBM2-Series\_Filter\_Boxes for full details.





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207 Queen's Quay West, Suite 615  
Toronto, Ontario  
M5J 1A7

## **ELECTRICAL SPECIFICATIONS**

FOR

**CITY OF TORONTO**

**ANIMAL SERVICES**

1300 SHEPPARD AVE W

TO

**CITY OF TORONTO**

DATED

**APRIL 08, 2024**

**ISSUED FOR TENDER**

Contact Person: Peera Butrsingkorn  
Phone: 416-598-2920 Ext. 359  
Email: [peera@mcw.com](mailto:peera@mcw.com)

MCW Project No. 22241H

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26 05 00	ELECTRICAL GENERAL REQUIREMENTS
26 05 01	SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
26 05 05	BASIC MATERIALS AND METHODS
26 05 10	ELECTRICAL IDENTIFICATION
26 05 14	WORK IN EXISTING BUILDING
26 05 21	WIRE AND CABLE UP TO 600 VOLTS
26 05 27	GROUNDING AND BONDING
26 05 29	HANGERS AND SUPPORTS
26 05 33	RACEWAYS AND BOXES
26 12 16	TRANSFORMERS
26 24 16	PANELBOARDS
26 28 13	FUSES
26 28 23	SAFETY SWITCHES

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.

1.02 APPLICATION

- .1 This Section applies to and is a part of all Sections of Division 26.

1.03 DEFINITIONS

- .1 "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.
- .2 Wherever the term "This Sub-Contractor" is used in the Division 26 Drawings and Specifications, it means the firm having a subcontract with the "Contractor" to perform, supervise and co-ordinate all work of this Division.
- .3 Wherever the term "install" (and tenses of "install") is used in the Division 26 Drawings and Specifications, it means install and connect complete.
- .4 Wherever the term "supply" is used in the Division 26 Drawings and Specifications, it means supply only.
- .5 Wherever the term "Provide" or "Provision of" are used in relationship to equipment and other materials specified for the Work of Division 26 it means "Supply, Install and Connect". Wherever the terms "Provide" or "Provision of" are used in connection with services such as testing, start-up and commissioning for any part of the Work of Division 26, it means procure, supervise, take responsibility and pay for these services.
- .6 Whenever "Drawings and Specifications" are referred to herein, it means "the Contract Documents".
- .7 Wherever the terms "Authorities" or "Authorities having jurisdiction" are used in the Division 26, Drawings and Specifications, it shall mean any and all current laws and/or by-laws of any federal, provincial] or local authorized agencies having jurisdiction over the sum total or parts of the work including, but not restricted to the Municipal Planning and Building Department, Municipal Fire Department, The Construction Safety Act, Municipal Public Works Department, Federal and/or Provincial Fire Marshall, the Ontario Electrical Safety Code and the Ontario Building Code.
- .8 Wherever the term "Work" is used in the Division 26 Drawings and Specifications, it means all equipment, permits, materials and labour to provide a complete electrical installation as required and detailed in the Drawings and Specifications.
- .9 Wherever the term "Acceptable" is used in the Division 26 Drawings and Specifications it means acceptable to the Consultant.



#### 1.04 WORK INCLUDED

- .1 Sections of Division 26 are not intended to delegate functions nor to delegate work and supply to any specific trade and the Work shall include all labour, materials, equipment and tools required for a complete and working installation as described, but not necessarily limited to items in the following Sections:

Section 26 05 00	Electrical General Requirements
Section 26 05 01	Shop Drawings, Product Data and Samples
Section 26 05 05	Basic Materials and Methods
Section 26 05 10	Electrical Identification
Section 26 05 14	Work in Existing Building
Section 26 05 21	Wire and Cable Up To 600 Volts
Section 26 05 27	Grounding and Bonding
Section 26 05 29	Hangers and Supports
Section 26 05 33	Raceways and Boxes
Section 26 12 16	Transformers
Section 26 24 16	Panelboards
Section 26 28 13	Fuses
Section 26 28 23	Safety Switches

#### 1.05 PERMITS, FEES AND INSPECTIONS

- .1 Apply for, obtain, and pay for all permits, licenses, inspections, examinations and fees required for Work of Division 26.
- .2 If the municipality is structured as a "single permit jurisdiction", the Contractor will apply, pay for and obtain the municipal building permit. In this case, the Division 26 contractor has no financial obligation for permit application except for permits not covered in the "single permit".
- .3 Arrange for inspection of all Work by the Authorities having jurisdiction over the Work. On completion of the Work, present to the Consultant the final unconditional certificate of approval of the inspecting Authorities.
- .4 Comply with the requirements of the latest edition of the applicable CSA standards, the requirements of the Authorities, Federal, Provincial and Municipal Codes, the applicable standards of the Underwriters' Association and all other Authorities having jurisdiction. These codes and regulations constitute an integral part of these specifications.
- .5 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.
- .6 Before starting any work, submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Consultant immediately of such changes. Prepare and furnish any additional drawings, details or information as may be required.

#### 1.06 CONTRACT DRAWINGS

- .1 The Drawings for Electrical work are performance drawings, diagrammatic, intended to convey the scope of work and indicate general arrangement and approximate location of apparatus, fixtures and conduit runs. The Drawings do not intend to show architectural and structural details.
- .2 Do not scale Drawings. Obtain information involving accurate dimensions from dimensions shown on Architectural and Structural drawings, and by site measurement.
- .3 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (conduits around beams, columns, etc.)
- .4 Alter, at no additional cost, the locations of materials and/or equipment as directed that do not necessitate additional material.
- .5 Install ceiling mounted components (e.g., light fixtures, speakers, heat or smoke detectors) in accordance with reflected ceiling drawings.
- .6 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to Architectural and Structural details.

#### 1.07 EXAMINATION OF SITE AND DOCUMENTATIONS

- .1 Prior to submitting tender, carefully examine conditions at the site which could affect the Work. Refer to and examine all contract documents.
- .2 Be responsible for any damage done to existing underground services caused by neglect to determine and mark out the location of such services prior to excavation work commencing.
- .3 Refer to room finish schedules to determine finished, partially finished and unfinished areas of the building.
- .4 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into the spaces where they are to be located without difficulty. Be responsible for any cutting and patching involved in getting assemblies into place.

#### 1.08 CO-ORDINATION DRAWINGS

- .1 Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure, and all inserts, equipment bases, and supports, and relate these to suitable grid lines and elevation datum.
- .2 When requested, provide weights of major items of equipment.
- .3 Prepare interference and co-ordination drawings for all areas where the work of this Division could conflict with and/or obstruct the work of other trades and/or other Sections of this Division. Submit drawings for review by the Consultant.

1.09 RECORD DRAWINGS

- .1 The drawings for this Project have been prepared using REVIT. For the purpose of producing record (as-built), the consultant will provide a BIM Model to the subcontractor at no cost.
- .2 In the event cad files are required, copies of contract drawings may be purchased from the Consultant based on the following rates plus GST:

For 1 to 10 files	\$550.00
For 11 to 20 files	\$650.00
For 21 to 50 files	\$850.00
For 51 to 100 files	\$1,350.00
For greater than 100 files, charge \$10.00 per file + \$350.00.	

In using the drawings from the Consultant to produce record drawings, the Contractor is deemed to have agreed to take full responsibility for any and all information on the drawings.

- .3 Obtain a set of white prints as the job progresses, mark this set to accurately indicate installed work. Show location by dimension from walls or columns for all buried services as well as invert depths. Have these white prints available for inspection at the site at all times, and present for scrutiny at each job meeting.
- .4 At completion of the project, transfer all information from the white prints to the REVIT files, and provide one USB Flash Drive with updated files to the Client as part of the close out documents.
- .5 The Division 26 contractor is responsible for all cost associated with the production and services required, such as recreating, plotting and printing to produce "as-built" drawings.

1.10 PRODUCT STANDARDS AND ALTERNATIVES

- .1 Provide new material and equipment as specified and to the acceptance of the Consultant. Manufacturer's names are listed to set a standard of quality, performance, capacity, appearance and serviceability. Other acceptable manufacturers are also listed, and their names may be used in the submission of the Electrical List of Manufacturers, Subtrades and Separate and Unit Prices Tender subject to conditions stipulated in paragraph .3 of this article.
- .2 Where no other acceptable manufacturers are indicated, provide the exact make specified. Requests for acceptance of manufacturers not listed must be submitted not less than seven working days prior to closing date of the tender and submissions must bear proof of acceptance by the Consultant if used in the tender.
- .3 Assume full responsibility for ensuring that when providing other acceptable manufacturers all space, weight, connections, power and wiring requirements, etc., are considered, and costs therefore included in the tender. Equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.
- .4 All electrical equipment, material, wiring and devices to conform to the Canadian Electrical Code for the purpose for which they are to be used and bear the approval of the CSA or have special approval of the inspection authority. All equipments to be designed and manufactured in accordance with applicable EEMAC and ANSI specifications.

**1.11 PATENTS**

- .1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights, and save the Owner and Consultant harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters, patent or patent rights, by this Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement or such letters, patent or rights.

**1.12 RIGHTS RESERVED**

- .1 Rights are reserved to furnish any additional detail drawings, which in the judgement of the Consultant may be necessary to clarify the work, and such drawings shall form a part of this contract.

**1.13 EQUIPMENT NAMEPLATES**

- .1 Provide apparatus with proper nameplates affixed thereto, showing the size, name of equipment, serial number and all information usually provided, which also includes voltage, cycle, phase, horsepower of motors and the name and address of the manufacturer.

**1.14 EXPEDITING AND DELIVERY**

- .1 Continuously check and expedite delivery of equipment and materials, if necessary, inspect at the source of manufacture.
- .2 Continuously check and expedite the flow of necessary information to and from all parties involved.
- .3 Immediately inform the Consultant in case information is required from him.
- .4 Provide delivery records updated monthly.

**1.15 SUPERINTENDENCE**

- .1 Maintain at the job site, at all times, qualified personnel and supporting staff, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
- .2 The supervising personnel and their qualifications are subject to the approval of the Consultant.

**1.16 WORKMANSHIP**

- .1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to function properly to the satisfaction of the Consultant. Install runs parallel and perpendicular to building lines, in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are to be exposed install neatly and group to present a tidy appearance.
- .2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore.

- .3 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers installation instructions.
- .4 Replace work unsatisfactory to the Consultant without extra cost.
- .5 Make provision to accommodate future plant and equipment indicated on drawings.
- .6 Protect from damage all equipment delivered to the site and during installation. Any damage or marking of finished surfaces shall be made good to the satisfaction of the Consultant.

#### 1.17 TRIAL USAGE AND TESTS

- .1 The Owner has the privilege of the trial usage of Electrical Systems or parts thereof for the purpose of testing and learning the operational procedures.
- .2 Assist in trial usage over a length of time as deemed reasonable by the Consultant at no extra cost and do not waive any responsibility because of trial usage.
- .3 Trial usage shall not be construed as Substantial Completion of the Work, or acceptance by the Owner.
- .4 Provide and pay for all testing required on the system components where, in the opinion of the Consultant, manufacturer's ratings or specified performance is not being achieved.

#### 1.18 CLEANING

- .1 Before energizing any systems, inspect and clean the inside of panel boards, switchgear and cabinets to ensure that they are completely free from dust and debris.
- .2 Clean all polished, painted and plated work bright. Clean all lighting fixtures.
- .3 Remove all debris, surplus material and all tools.
- .4 Carry out additional cleaning operating of systems as specified in other sections of the specification.

#### 1.19 COMPLETION

- .1 Leave electrical work in specified working order.

#### 1.20 WARRANTIES

- .1 Provide 2 year warranty certificates for all services.

- .2 Wherever given or required, in excess of the normal warranty period, provide certificate showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and systems.

#### 1.21 INSTRUCTION TO OWNERS

- .1 Instruct the Owner's representatives in all aspects of the operation of systems and equipment.
- .2 Arrange for and pay for services of service engineers and other manufacturers' representatives required for instruction on specialized portions of the installation.
- .3 Submit to the Consultant at the time of final inspection a complete list of systems stating for each system:
  - .1 Date instructions were given to the Owner's staff.
  - .2 Duration of instruction.
  - .3 Name of persons instructed.
  - .4 Other parties present (manufacturer's representative, consultants, etc.).
- .4 Signatures of the Owner's staff stating that they properly understood the system installation, operation and maintenance requirements.

#### 1.22 DOCUMENTATION AND SYSTEMS ACCEPTANCE

- .1 Assemble three (3) copies of operating and instruction manuals in three ring binders with index tabs each containing this subcontractor's and suppliers names and telephone numbers.
- .2 Each manual shall contain the following data:
  - .1 A set of as-built prints.
  - .2 Letters of Owner's Instructions
  - .3 Final Hydro certificate.
  - .4 A copy of each "reviewed" shop drawing.
  - .5 Complete explanation of operation principles and sequences.
  - .6 Complete part lists with numbers.
  - .7 Recommended maintenance practices and precautions.
  - .8 Complete wiring and connections diagrams.
  - .9 Certificate of warranty.
- .3 Ensure that operating and maintenance instructions are specific and apply to the models and types of equipment provided.

#### 1.23 OWNER'S RIGHT TO RELOCATE ELECTRICAL ITEMS

- .1 The Owner reserves the right to relocate electrical outlets at a later date, but prior to installation, without cost, assuming that the relocation per outlet does not exceed 3000 mm from the original location. No credits shall be anticipated where relocation per outlet of up to and including 3000 mm reduces materials, products and labour.
- .2 Necessary changes, due to lack of co-ordination, and as required and when approved, shall be made at no additional cost, to accommodate structural and building conditions. The location of conduits and other equipment shall be altered without charge to the Owner, if approved, provided the change is made before installation.

#### 1.24 MUNICIPAL AND UTILITY SERVICES

- .1 Co-ordinate, arrange, and pay for (provide cost to owner) all utility connections and fees as required and shown on the drawings, complete with all required metering. Install all metering equipment in accordance with municipal or utility requirements.

#### 1.25 PHASING AND SCHEDULING OF WORK

- .1 Refer to Scope of work for a detailed description of the phasing and scheduling of the work. Execute work in accordance with the phasing and construction schedule. Provide all necessary temporary connections and equipment to provide functional, operational systems during construction period when part of the building will be occupied and construction is still continuing in other portions.

#### 1.26 MATERIALS FURNISHED BY OTHERS

- .1 Where materials are furnished by others for installation under this Division, the Sub-Contractor shall notify the supplier of dates he will be ready for delivery as specified in the General Conditions. The Sub-Contractor shall receive, unload, handle, store, protect and insure the material until ready for actual installation. Upon receipt of material furnished by others, the Sub-Contractor shall spot-check or check the entire shipment and promptly advise the Consultant in writing of any damage and/or missing components. Any material which is subsequently lost or damaged due to negligence on the part of the Sub-Contractor shall be promptly replaced (or repaired to the satisfaction of the Owner) at the Sub-Contractor's expense.

#### 1.27 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS.

- .1 Where the Drawings indicated equipment to be furnished by others, provide Electrical rough-in for each unit pursuant to its shop drawings, and make final connections, disconnect switches and other electrical facilities for a complete installation.

#### 1.28 ELECTRICAL LEGEND & SCHEDULES

- .1 Refer to Electrical Drawings for Legend and Schedules

### PART 2 - PRODUCTS

2.01 NIL

### PART 3 - EXECUTION

3.01 NIL

END OF SECTION 26 05 00



PART 1 - GENERAL

1.01 GENERAL

- .1 Submit Shop Drawings, Product Data and Samples as specified herein.
- .2 Designate in the Construction Schedule, or in a separate coordination schedule, dates for submission and dates that reviewed Shop Drawings, Product Data and Sample will be required. Give due consideration for review time required by the Consultant, with a minimum of fifteen (15) working days required. The submission of Appendix 'B' will be considered an acceptable submittal schedule.
- .3 All data and dimensions on shop drawings, product data and sample information to be based on units (Imperial or Metric) as shown on the contract documents.
- .4 Shop Drawings with errors or omissions and deviations will be returned "Not Reviewed".
- .5 The Contractor's responsibility for deviations in submission from the requirements of Contract Documents is not relieved by the Consultant's review of submittals, unless a deviation on the submittal is noted as such in writing and has been accepted by the Consultant.
- .1 Keep one (1) reviewed copy of each submission on site.

1.02 SHOP DRAWINGS

- .1 Review and stamp Shop Drawings, Product Data and Samples prior to submission to the Consultant. Confirm that necessary requirements have been determined and verified and that each submittal has been checked and coordinated with requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project, will be returned without being examined and shall be re-submitted when completed.
- .2 In the event expedited shop drawings reviews are required, be prepared to attend and participate at the request of the project manager with the appropriate shop drawings in hand.
- .3 Submit drawings in a clear and thorough manner:
  - .1 Identify details by reference to drawing No. and detail, schedule or room numbers as shown on Contract Documents.
  - .2 Minimum sheet size and larger sheets to be multiples of 8½" x 11".
  - .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated. Indicate cross references to design drawings and specification.
  - .4 Adjustments to shop drawings by the Consultant do not change the cost of the work. If adjustments affect the cost of Work, advise through normal channels in writing prior to proceeding with the Work.
  - .5 Make changes in shop drawings as directed by the Consultant. Resubmit and note any revisions other than those requested.
  - .6 If only minor adjustments are made, shop drawings to be returned and fabrication and installation of work to proceed.
- .4 Determine and verify:
  - .1 Field measurements.

- .2 Field construction criteria.
- .3 Catalogue numbers and similar data.
- .4 Conformance with Specifications.
  
- .5 Co-ordinate each submittal with requirements of the Contract documents.
  
- .6 Each Shop Drawing will be stamped by the Consultant in the following format:
  - NOT REVIEWED                       REVIEWED
  - RESUBMIT                               REVIEWED AS MODIFIED
  - NOT SPECIFIED BY MCW, REVIEWED FOR MEP ONLY
  
- .7 This review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approved the detail design inherent in the shop drawings, responsibility for which shall remain with this Subcontractor submitting same, and such review shall not relieve this Subcontractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the contract documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication.
  
- .8 Products not specified by MCW are reviewed to confirm compliance with services provided only. Any changes required between provided services and shop drawing requirements will be identified for coordination between trades.
  
- .9 Shop drawings shall be accompanied by a complete copy of the attached "Shop Drawing Submittal Sheet" Section 26 05 01, Appendix 'A'.
  
- .10 Begin no fabrication or work which requires submittals until return of submittals reviewed by Consultant.

### 1.03 PRODUCT DATA

- .1 Where specified, Manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data is acceptable provided there is conformance with the following:
  - .1 Clearly identify pertinent products or models.
  - .2 Show performance characteristics and capacities.
  - .3 Show dimensions and clearances required.
  - .4 Show wiring or piping diagrams and controls.
  
- .2 Manufacturer's standard schematic drawings and diagrams may require modifications to drawings and diagrams to provide information applicable to the Work.
  
- .3 Provide information specifically applicable to the Work.

### 1.04 SAMPLES

- .1 Samples to be labelled, of sufficient size and quantity to clearly illustrate:
  - .1 Functional characteristics integrally related parts and attachment devices.
  - .2 Full range of colour, texture and pattern.
  
- .2 Field Samples and mock-ups:
  - .1 Erect, at the project site and in location acceptable to the Consultant.
  - .2 Fabricate each sample and mock-up complete and finished.

- .3 Remove mock-ups at conclusion of Work or as specified by the Consultant.

#### 1.05 SUBMISSION REQUIREMENTS

- .1 Submit promptly to approved schedule and in sequence to prevent submission delay in the Work.
- .2 Submission requirements:
  - .1 Shop Drawings: Submit shop drawings electronically. Coordinate submission with the construction team and the start of the project.
  - .2 Product Data: Submit a copy for each O & M Manual.
  - .3 Samples: Submit as specified, or as requested during the shop drawing review period.

#### 1.06 RESUBMISSION REQUIREMENTS

- .1 Make corrections or changes to the submittals noted by the Consultant and resubmit.
- .2 Shop Drawings and Product Data:
  - .1 Revise drawings or data, and resubmit as noted on the initial submittal.
  - .2 Indicate any changes which have been made other than those noted by the Consultant.
- .3 Samples: Submit new samples as required for initial submittal as soon as possible after notification of the rejection of the original submission and mark "resubmitted samples".

#### 1.07 DISTRIBUTION

- .1 Distribute reproductions of Shop Drawings and copies of Product Data which carry the Consultant's stamp to all parties as specified by Division One General Requirements.
  - .1 Job site file
  - .2 Project record document file
  - .3 Other affected contractors
  - .4 Subcontractors
  - .5 Supplier or fabricator (as applicable)
  - .6 Operations Manual.

#### PART 2 - PRODUCTS

2.01 NIL

#### PART 3 - EXECUTION

3.01 NIL

END OF SECTION 26 05 01

SHOP DRAWING SUBMITTAL SHEET

Project: City of Toronto Date:  
Animal Services  
1300 Sheppard Ave W

Project No. 22241H Submittal No.

Section:

Equipment Description

Contractor:

Sub-Contractor:

Suppliers Name:

Manufacturer:

Catalogue No.:

Variations From  
Tender Documents

Engineer: MCW Consultants Ltd.  
207 Queen's Quay West, Suite 615  
Toronto, Ontario  
M5J 1A7



PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide materials as specified herein to complete the work as required by the contract documents.

1.03 SUBMITTALS

- .1 Submit Shop drawings as required.

PART 2 - PRODUCTS

2.01 SLEEVES

- .1 In concrete slabs, except as noted below, sleeves shall be #24 gauge galvanized steel or factory fabricated plastic sleeves, each with an integral flange to secure the sleeve to form work construction. Sleeves to extend 50mm (2") above finished slab to prevent water infiltration into or through the sleeve.
- .2 In waterproof concrete slabs and in other slabs where waterproof sleeves are required, provide Schedule 40 mild galvanized steel.

2.02 INSERTS AND BEAM CLAMPS

- .1 Inserts for concrete form work shall be Crane Canada Ltd., #4-M Unistrut Ltd., or approved equal cast iron inserts, multiple type where required.
- .2 Inserts for precast concrete and existing concrete shall be lead cinch anchors of "WEJ-IT" or self-drilling "STARR" or "PHILLIPS" anchors.
- .3 Beam clamps for hanging and support to structural steel shall be Crane Canada Ltd., or equal.

2.03 ACCESS DOORS

- .1 Minimum #12 gauge prime coat painted steel flush access doors, each complete with a heavy frame and anchor, heavy duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing provisions to suit the particular construction in which it is installed. Access door sizes shall suit the concealed work for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc., shall be ULC listed and labelled and of a rating to maintain the fire separation integrity.

- .2 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION OF SLEEVES

- .1 Where conduits, raceways and conductors pass through structural poured concrete, supply sleeves, unless otherwise noted.
- .2 Size sleeves, unless otherwise noted, to leave 12mm clearance around the conduit, raceway, etc. Pack and seal the void between the sleeves and the conduit, raceway, conductor etc. for the length of the sleeves.
- .3 Pack all sleeves with a ULC and CSA approved one part intumescent elastomer as manufactured by 3M. The installation shall be formed for each specific application using the manufacturers recommended combination of the following:
  - .1 P25 caulk, Puty 303, penetration sealing system 7902 or 7904, composite sheet CS195 or wrap strip FS-195.
- .4 In poured concrete construction, accurately locate sleeves, and turn these sleeves over to the Division performing the concrete work for placement in the concrete form work. Sleeves shall be sufficiently rigid to prevent sleeve deformation when the concrete is poured, and shall be suitably plugged to prevent concrete from entering the sleeve.
- .5 Submit to the concrete reinforcement detailer at the proper times, drawings, indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and shall relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .6 Supply sleeves of a water protecting type for installation in the following locations:
  - .1 In Mechanical and Fan Room floor slabs except where on grade;
  - .2 In slabs over Mechanical, Fan, Electrical and Telephone equipment rooms or closets;
  - .3 In all floors equipped with waterproof membranes;
  - .4 In the roof.
- .7 "Gang" type sleeving will be permitted only with the Consultant's approval.
- .8 Terminate sleeves for work which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeves may be completely covered by escutcheon plates.
- .9 Openings for multiple conduit or conductor runs, etc., will be provided by the Division responsible for the particular construction in which the opening is required. Carefully co-ordinate the opening locations with the particular Division and ensure that openings are suitably sized and located. Seal the space between the opening and the conduit, conductors, etc., for the length of the opening as for sleeves above.

- .10 Where a round or formed opening is required, where placement of a sleeve has been missed, or where provision of an opening has not been properly co-ordinated with the Concrete Division, neatly cut a suitably sized hole or opening using proper tools to the approval of the Consultant. Prior to cutting any such holes or openings, determine whether or not any reinforcing steel or services, are concealed behind the surface where the hole or opening is to be cut and be responsible for all costs incurred for correcting any damage caused to the structure or services due to cutting holes or openings without prior study and approval.

### 3.02 INSTALLATION OF INSERTS AND BEAM CLAMPS

- .1 Provide all inserts, beam clamps, fasteners, and similar hardware required for conduit, duct, raceway, conductor, etc., and equipment hanger and/or support materials unless otherwise noted.
- .2 Accurately and properly set concrete inserts in the concrete framework.
- .3 For runs of three (3) or more conduits, raceways, or conductors in concrete form work, use multiple type inserts used for the smallest conduit in the group.
- .4 Where inserts are required in pre-cast concrete and in concrete work where concrete inserts have not been installed, drill a neat hole of the proper diameter and depth in the concrete and insert an anchor to accept the hanger rod, bolt, etc. or where concrete mass permits, use self-drilling concrete anchors.
- .5 Fasten hangers and support provisions to brick or masonry with expansion shields and machine bolts, or for light loads, use plugs and screws.
- .6 In cavity walls and/or ceilings, use two (2) wing toggles and for heavy loads, provide steel anchor plates with two (2) or more toggles to spread the load.
- .7 Provide beam clamps for attaching, hanging and/or support provisions to structural steel, or where approved by the Consultant, weld the hanging and support provisions to the structural steel.
- .8 Explosive power actuated fasteners will not be permitted unless specific approval for their use has been obtained from the Consultant.
- .9 Use fibre or lead screw anchors for anchoring screws.

### 3.03 SUPPLY OF ACCESS DOORS

- .1 Supply access doors to give access to all junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair but which is concealed in inaccessible construction except as otherwise specified herein or on the drawings.



- .2 Before commencing installation of electrical work, prepare on a set of reflected ceiling plans with complete layouts of all ceiling access door which will be required. Submit these layouts to the Architect for approval and show the exact sizes and locations of such ceiling access doors. Locate access doors in walls and partitions to the Consultant's approval, and arrange electrical work to suit.
- .3 Supply the respective trade with panels, doors or the frames therefore complete with all pertinent information and pay their trade for installation.
- .4 Access doors shall be, wherever possible, of a standard size, for all applications. Confirm exact dimensions with the Consultant, prior to ordering.
- .5 Submit a sample of each proposed type of access door to the Consultant for approval.

#### 3.04 PLYWOOD

- .1 Provide all plywood indicated on the drawings required for the work of Division 26. The backboards shall be 19mm thick, good one side and shall be impregnated with fire retardant material.

#### 3.05 EQUIPMENT CURBS, BASES AND SUPPORTS

- .1 Set all floor mounted equipment on 100mm high concrete housekeeping pads 100mm wider and longer than the equipment base dimensions.
- .2 Furnish dimensioned drawings, templates and anchor bolts for proper setting of equipment on bases and pads. Provide all structural steel frames, brackets, etc., for equipment bases and supports unless otherwise noted, and be responsible for all required levelling, alignment and grouting of the equipment.
- .3 Provide structural steel stands for equipment where indicated or specified. Flange bolt stands to housekeeping pads.
- .4 Where equipment is suspended above floor level it shall be, unless otherwise noted, supported on a suitable structural steel angles or channels bracketed to the wall or secured by hanger rods to slab construction, or where loading is excessive, from separate structural steel members carried to either the floor or ceiling, or both as required.

#### 3.06 EXCAVATION AND BACKFILL

- .1 Do all excavating bedding backfill and related work for the work of Division 26 as specified therein.
- .2 For all electrical excavation, excavate to 150mm below and a minimum of 200mm to either side of the cable or duct run. Fill back with a bedding of granular 'A' gravel or sand. Minimum coverage shall be 750mm.
- .3 Refer to details on the drawings and to utility company requirements for concrete encased duct installation.

- .4 Where excavation is necessary in proximity to and below the level of any footings, bed with concrete to the level of the highest adjacent footing. Concrete strength shall be as directed by the Consultant.
- .5 Carry out pavement cutting and repair of the Owners and Public Property as may be required for excavation and backfill work.

### 3.07 CONCRETE

- .1 Do all concrete or related work required for the work of Division 26 as specified herein.
- .2 Division 26 shall be responsible for all co-ordination to meet authority having jurisdiction requirements for ducts, provision of ducts and fittings as specified.

### 3.08 CUTTING AND PATCHING

- .1 Inform other trades in time concerning required openings. In work already finished, cutting and patching shall be done by the trades installing the affected work, at the expense of Division 26. Obtain the approval of the Consultant, before doing any cutting.

### 3.09 PROVISION FOR SERVICES CROSSING BUILDING EXPANSION JOINTS

- .1 Wherever services (conduit, cables etc.) cross building expansion joints, install the services in such a manner to permit free movement without imposing additional stress or loading upon the support system, and to prevent excessive movement at joints and connections.

### 3.10 SPRINKLER PROTECTION

- .1 Weatherproof equipment where noted in the specifications and/or drawings shall have EEMAC Type 3 enclosure in accordance with the requirements of CSA C22.2 No. 94 Standard.

### 3.11 FLASHING

- .1 Flash all electrical parts passing through or built into an outside wall, or a waterproof floor.
- .2 Provide copper flashing for sleeves passing through exterior walls or water proof floors.
- .3 Provide counter flashing on conduits passing through roofs to fit over flashing or curb. Supply flashing to appropriate division for installation.

### 3.12 METALS

- .1 Steel construction required solely for the work of electrical trades and not shown on architectural or structural drawings shall be provided by Division 26 to the acceptance of the Consultant.

### 3.13 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to center line of equipment unless specified or indicated otherwise.

- .2 If mounting height of equipment is not indicated verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise.
- .4 Prior to rough-in, co-ordinate and have approved by the Consultant all mounting heights of devices.
- .5 Mounting heights shall meet the requirements of the "Barrier Free" section of OBC.
  - .1 Local switches: 1100mm
  - .2 Local switches in suites: 950mm
  - .3 Wall receptacles:
    - .1 General: 400mm
    - .2 Above top of continuous baseboard heater: 200mm
    - .3 Above top of counters or splash back: 175mm
    - .4 In mechanical room: 1200mm
  - .4 Panelboards (to top of panel trim): 1850mm
  - .5 Telephone and interphone outlets. 400mm
  - .6 Wall mounted telephone and interphone outlets: 1100mm
  - .7 Fire alarm stations: 1100mm
  - .8 Fire alarm Signalling Devices: 2300mm or 150mm below Ceiling, to top of device
  - .9 Television outlets: 400mm
  - .10 Pay Telephones: 1100mm

END OF SECTION 26 05 05

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide lamacoid nameplates and other identification means for a complete installation.

1.03 SUBMITTALS

- .1 Submit a list of proposed labels for review prior to manufacturing.

PART 2 - PRODUCTS

2.01 NIL

PART 3 - EXECUTION

3.01 STANDARD IDENTIFICATION

- .1 Identify electrical work as specified herein:
  - .1 For each piece of electrical distribution equipment from the electrical source of supply up to and including panelboards and motor systems, for special control panels and cabinets, and for any other piece of equipment where specified in this Section, provide engraved lamacoid identification nameplates.
  - .2 Nameplates shall generally be black-white-black with bevelled edges, secured to apparatus with stainless steel screws. Generally lettering shall be 6mm high but equipment in the main electrical room shall be provided with lettering 13mm high.
  - .3 Warning signs, if and when required, shall be red with white lettering.
  - .4 Equip large multiple cell or component apparatus such as switchboards and distribution panels with main nameplates identifying the equipment, voltage characteristics and capacity and with sub-nameplates clearly identifying each cell or component and its service.
  - .5 Panelboard nameplates shall identify the panelboard numbers designated on the drawings, unless otherwise instructed. Nameplates for disconnect switches, control panels and cabinets shall outline their service.
  - .6 Motor starters, magnetic and manual, shall identify the piece of motorized equipment being serviced.
  - .7 Exact nameplate wording and sizes must be approved by and confirmed by the Consultant prior to manufacture.
  - .8 Directories for branch circuit panelboards shall be clearly and neatly typewritten, accurately identifying the type, location and wattage of the connected load for each circuit breaker. Directories shall be secured to the rear of the cabinet door under protective plastic. Incorporate copies of all panel board directories in each copy of operating and instruction manuals.
  - .9 Clearly identify each branch circuit breaker in a permanent manner to correspond with directories. Glued paper identification will not be acceptable.

- .10 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting the outside of the covers. Paint colours shall be in accordance with the following schedule:
  - .1 Lighting - Yellow
  - .2 Power - Blue
  - .3 Emergency Power - Orange
  - .4 Fire Alarm - Red
  - .5 Telephone - Cream
  - .6 Miscellaneous Signals - Brown
- .11 In addition to painting miscellaneous signal boxes clearly identify the specific system in which the box is installed.
- .12 Colour code empty conduit capped and terminated for future use as specified above and clearly identify its intended use by means of securely attached tags.
- .13 Colour code conductors throughout to identify phases, neutrals and grounds, by means of coloured conductor insulation. Colours shall be as follows:
  - .1 Phase A Red
  - .2 Phase B Black
  - .3 Phase C Blue
  - .4 Ground Green
  - .5 Neutral White
- .14 Control conductors, in addition, shall be numbered with Brady Ltd., or Electrovert Ltd., Z-type markers. Colour code conductors, for special component per manufacturer's recommendations.

### 3.02 PAINTING AND FINISHES

- .1 Painting of exposed electrical work will be done as part of the work of Section 09900. Equipment to be located in finished areas shall be provided to site prime coated.
- .2 All exposed electrical fittings, supports, hangers, frames conduit, racks, boxes, raceways and similar material and apparatus shall be galvanized or finished with corrosion resistant primer ready to accept paint. Take special care when priming work exposed to the elements or in wet areas to prevent rust or corrosion from damaging adjacent surfaces.
- .3 All large switchgear, transformers, distribution centres, panelboard, starters, disconnects or similar apparatus shall be factory finished in gloss air dry enamel over corrosion resistant sealer primer. Unless specified to the contrary, this finish shall be ASA #61 grey.
- .4 Touch-up and/or repaint any factory finished equipment not scheduled to be painted by Section 09900 that has been scratched or otherwise damaged during installation.

END OF SECTION 26 05 10

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Demolition and restoration of areas as identified on the contract documents.

**1.03 WORK IN EXISTING BUILDING**

- .1 The building shall remain open and in operation during the construction period.
- .2 Where existing services such as electrical power, fire alarm system, television system etc., are required to be disrupted and/or shut-down, co-ordinate the shut-downs with the Owner and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 72 hours in advance of performing work and obtain Owner's written consent prior to implementing.
- .3 Where disruption to life safety systems are required, comply with paragraph above and provide continuous monitoring during shut down period and ensure that all systems are reactivated prior to leaving site at the end of each working day.
- .4 Should any temporary connections be required to maintain services during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of the Consultant.
- .5 Refer to Division 1 for phasing and staging of work and adhere to that program. Comply with instructions regarding working hours necessary to maintain the building in operation].
- .6 The drawings indicating items of equipment to be deleted or relocated have been prepared as a guideline for this subcontractor, but shall not be construed as indicating every item of equipment or conduit. Be responsible for determining site conditions by personal examination.
- .7 Where existing services (conduits, receptacles, switches, etc.) presently mounted on and/or concealed behind existing finishes become exposed during the renovation work and where these services will not be concealed behind or mounted on new finishes, include for relocating the service so as to be concealed behind or on new or existing finishes. Co-ordinate new locations with the Consultant.

**PART 2 - PRODUCTS**

**2.01 NIL**

**PART 3 - EXECUTION**

**3.01 NIL**

END OF SECTION 26 05 14

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide all wiring as specified herein for a complete installation, as required by the contract documents.

1.03 SUBMITTALS

- .1 Submit shop drawings of building wire and cables.
- .2 Submit a list of feeders used on the project, indicating cable type and size.

1.04 ACCEPTABLE MANUFACTURERS

- .1 Acceptable manufacturers are; Canada Wire, Pirelli, Alcan NuAl and Pyrotex MI Cable where specified.

PART 2 - PRODUCTS

2.01 BRANCH CIRCUIT CONDUCTORS

- .1 "RW90" single conductor to CSA C22.2 No. 38-95, colour coded 90°C rated, with approved manufactured connectors at joints.
- .2 "RWU90" (-40°C) single conductor to CSA C22.2 No. 38-95, colour coded, 90°C rated, with joints soldered and taped to the Consultant's approval.
- .3 Flexible armoured cable, CSA type "AC-90" to CSA C22.2 □ 51-95.
- .4 "TWH" single conductor to CSA C22.2 No. 75-M1983 (R1992), colour coded, 90°C, rated with approved manufactured connectors at joints.
- .5 Single conductor colour-coded, rubber insulated wire to CSA type "R90" 90°C rated.
- .6 NuAl conductors where shown to be used, shall be provided with compression terminations, applied with corrosion preventing compound, and hydraulic or power activated tools shall be used for all connections.

- .7 Branch circuit conductors up to and including #12 AWG shall be solid. Branch circuit conductors in sizes larger than #12 AWG shall be stranded. All branch circuit conductors shall be constructed of 98% conductive copper, unless otherwise noted, and shall be approved for 600 volts.
- .8 Electric service, distribution and special conductors are specified in this Section and/or on the drawings.
- .9 Lubricant shall be Ideal "Yellow 77" or approved equal.

## 2.02 LOW VOLTAGE (24 VOLT) CONDUCTORS

- .1 Colour-coded #18 AWG TFF thermoplastic insulated wire for 600 volt service, complete with the number of copper conductors required.

## 2.03 MICC CABLE

- .1 Pyrotanax of Canada Ltd. two hour rated mineral insulated cables and accessories to CSA standard C22.2 No. 124 (R1981).
- .2 Conductors shall be solid bare soft annealed copper.
- .3 Insulation shall be compressed powdered magnesium oxide to form compact homogeneous mass throughout the entire length of the cable.
- .4 The overall covering shall be an annealed seamless copper sheath type MI rated 600V, 250°C.
- .5 Terminations shall be factory pre-packaged kits.
  - .1 (1850°F with hose stream).
  - .2 Low toxicity index per NES-713.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF BRANCH CIRCUIT CONDUCTORS

- .1 Provide all required branch circuit conductors.
- .2 Conductors for branch circuit work inside the building and above ground, except as noted below, shall be as specified in Article #2.01 Item .1 above.
- .3 Conductors for branch circuit work underground as specified in Article #2.01, Item .2 above.
- .4 Conductors for branch circuit lighting work (fixture tails) in accessible ceiling spaces, maximum length 1500mm, and branch circuit work in cavity wall construction from wiring devices to ceiling spaces, maximum length 6m, shall be as specified in Article #2.01, Item 3 above.



- .5 Conductors for branch circuit work to electric heating coils and/or units shall be as specified in Article #2.01, Items .4 and .5 above.
- .6 Branch circuit conductor sizes are scheduled and/or specified on the drawings. Such sizes are minimum requirements and must be increased, where required, to suit the length of run and voltage drop.
- .7 Do not use conductors smaller than #12 AWG in systems over 30 volts, unless otherwise noted. Wiring in suites may be #14 AWG where 15 amp circuits are used.
- .8 Use lubricant when pulling wires into conduit. Ensure that wires are kept straight and are not twisted or abraded.
- .9 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .10 Splicing of all conductors shall be done with Ideal Wing nut #450 Series for conductors from #14 Awg to #8 Awg.
- .11 For all conductors larger than #8 AWG, splicing shall be done with Burndy Serut connectors wrapped with 3 m #33 scotch tape.
- .12 Provide a dedicated neutral for each branch circuit conductor unless noted otherwise.
- .13 Joints in all conductors shall be kept to a minimum and all conductors shall be installed in continuous unbroken runs.

### 3.02 INSTALLATION OF LOW VOLTAGE (24) VOLT CONDUCTORS

- .1 Install all low voltage wiring in conduit.
- .2 Refer to manufacturer's shop drawings for special requirements pertaining to low voltage wiring.
- .3 Refer to individual specification section and the drawings for additional wiring requirements.

### 3.03 INSTALLATION OF MICC CABLE

- .1 For feeders and branch circuit conductors which are used in connection with fire alarm systems and all life safety systems connected to a standby generator power source, and where such feeders and conductors are not embedded in concrete, utilize Pyrotenax MICC cables as specified. Adjust all conductor sizes as required to suit load as per the schedule on the drawings.
- .2 MICC cables shall be clipped and fastened on maximum 12" centres and shall be fastened within 6" of each bend.
- .3 All MICC cables shall be meggered out using a 1000 volt megger upon completion of terminations.

END OF SECTION 26 05 21

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide a complete system of electric service grounding as outlined herein and as specified and detailed on the drawings. Grounding shall comply with the requirements of all grounding work, which is required but not specified herein or shown on the drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- .1 All grounding conductors shall be stranded copper, bare or insulated as indicated on Drawings or in Specifications.
- .2 Use Cadweld or Burndy Thermoweld process for all weld connections. AMP of Canada Ltd. Wrench-Lok grounding connectors are an acceptable equivalent to welded connections.
- .3 All ground connectors to be designed and approved for grounding purposes.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Bond all interior non-electrical metallic piping systems to the electrical system ground
- .2 Ground the neutral point of each secondary wye connected transformer.
- .3 Ground all conduit, and all non-current carrying metal parts, equipment cases, frames etc.
- .4 Where conduit systems are used for grounds, provide all necessary bushings, studs and jumpers as may be required to maintain effective continuity of ground. Provide separate ground conductors in all non-metallic conduits and EMT conduit.
- .5 Ground each piece of fixed equipment back to the switchboard or panel feeding that equipment, by one of the following methods:

- .1 Install a separate bare soft drawn copper ground inside each feeder conduit. At the switchboard or distribution panel, provide a grounding bushing, loop the ground conductor through the bushing, and connect to the switchboard ground bus. At the fixed equipment, connect to an internal ground bus, or connect to the inside of the metal enclosure utilizing approved screws and connectors (remove all paint).
- .2 For branch circuits, the conduits may be used for grounding, provided seamless steel fittings are used on EMT and threaded fittings are used on rigid conduit. At each receptacle connect a stranded copper ground wire from the outlet box to the grounding terminal on the receptacle. Install a separate grounding conductor in all PVC conduits.
- .3 Where equipment is fed by a multi-conductor power cable, provide a ground conductor in the cable. At the switchboard or panel, connect to the ground bus. Use a grounding connector on the cable for positive grounding of the metallic sheath. Loop the ground wire to the grounding connector.
  
- .6 Where equipment is fed by single conductor flexible armoured cables, provide separate ground conductor and non-ferrous metallic plate and grounding connectors at the switchboard or panel for terminating cables. Run grounding conductor inside fixed equipment and terminate at the grounding connection. At the load end provide an insulating plate for terminating cables, the outer sheaths to be ungrounded.
  
- .7 Run a separate ground wire in all flexible conduits. Connect each end to ground bus or lug or connector.
  
- .8 Where mechanical protection is required for insulated grounding conductors install in rigid conduit. Use rigid PVC conduit in concrete or below grade slab and aluminium conduit in other locations.
  
- .9 Provide weld connection or wrench type grounding connectors for:
  - .1 All connections between grounding conductors.
  - .2 All connections between grounding conductors and cable lugs.
  
- .10 Arrange grounding to provide the minimum impedance paths for ground fault currents. Provide any additional grounding required for approval by the inspecting authorities.
  
- .11 Ground uninsulated metallic materials, which are located below surfaces heated by electric heating cable.

END OF SECTION 26 05 27

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide all hangers and supports as required to provide a complete and operational system as required by the contract documents.

PART 2 - PRODUCTS

2.01 SUPPORT CHANNELS

- .1 U-shape, size 41 x 41 x 2.5mm thick, surface mounted, suspended or set in poured concrete walls and ceilings, as required for the specific application.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems
  - .1 Support individual cable or conduit runs with 6mm dia. threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6mm dia. threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface-mounting of two or more conduits, use channels at 1.5m o.c. spacing.

- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION 26 05 29

PART 1 - PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide all conduits, fastenings, fittings and boxes for a complete installation, as required by the contract documents.

PART 2 - PRODUCTS

2.01 CONDUITS

- .1 Rigid galvanized steel, CSA C22.2 No. 45, with exterior zinc and interior enamel coatings, galvanized threads where factory cut, red lead coated threads where site cut, factory made bends where site bending is not possible, factory made and threaded fittings and “tomic” joints and terminations made with rigid galvanized steel couplings, concrete tight where required.
- .2 EMT (Thinwall), to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with set screw steel type connectors, concrete tight where required, maximum allowable size shall be 50mm diameter.
- .3 Galvanized steel flexible liquid-tight metallic conduit, to CSA C22.2 No. 56, complete with proper and suitable liquid-tight flexible galvanized steel conduit connectors at terminations.
- .4 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with suitable type steel connectors at terminations.
- .5 Rigid plastic (PVC) conduit to CSA C22.2 No. 211.1 complete with site made heat gun bends to 50mm diameter, factory made bends for conduit larger than 50mm, solvent weld joints with socket couplings and proper connectors and adaptors at terminations.
- .6 Electrical non-metallic tubing to CSA C22.2 No. 211.0 – M1984 complete with suitable type connections and couplings.
- .7 Conduit racks shall be Unistrut Ltd. Electrovert Ltd., “Cantruss”, Burndy Ltd., “Flexible” or equivalent.

2.02 STANDARD OUTLET BOXES

- .1 Sheet Steel outlet boxes:
  - .1 Electro galvanized steel single and multi-gang flush device boxes for flush installation.

- .2 Electro galvanized steel utility boxes for outlets connected to surface mounted EMT conduit in interior application.
- .3 102mm galvanized steel octagonal boxes for lighting fixture outlets
- .4 102mm galvanized square outlet boxes with extension and plaster ring for flush mounting in finished plaster walls.
  
- .2 Masonry boxes: Electro galvanized steel masonry single and multi-gang boxes for devices flush-mounted in exposed block walls.
  
- .3 Concrete boxes: Non-metallic concrete boxes with matching extension and plaster rings as required for flush-mounting in concrete.
  
- .4 Conduit boxes: Type FS and FD ferralloy boxes with factory threaded hubs and mounting feet for exterior surface wiring of switches and receptacles.
  
- .5 Each outlet box must be suitable in all respects for the application, and complete with securing lugs, knock-outs, and where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
  
- .6 Outlet boxes for special wiring devices, for special equipment and for special applications, if and where required, are specified hereinafter in this Section or on the drawings.
  
- .7 347 volt outlet boxes for 347 volt switching devices.
  
- .8 Provide blank cover plates for all boxes without wiring devices.

### 2.03 PULLBOXES AND JUNCTION BOXES

- .1 Pullboxes and junction boxes shall be constructed of galvanized or prime coated steel. Each shall be suitable in all respects for the applications, and complete with screw-on hinged covers as required.
  
- .2 The physical size of pullboxes shall be as required by the "Ontario Electrical Safety Code" to suit the number and size of conduits and conductors.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF CONDUITS

- .1 Install conduit concealed in all finished areas, and concealed to the degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical Rooms and Mechanical Rooms, unless otherwise noted on the drawings or specified herein. Refer to and examine the architectural drawings and on the drawings or specified herein. Refer to and examine the architectural drawings and room finish schedules to determine finished, partially finished and unfinished areas of the building.



- .2 Where conduits are exposed, arrange same to avoid interference with other work and parallel to the building lines. Where horizontal conduits are exposed, install as high as possible. Do not install conduit within 150mm of "hot" pipes or equipment unless the conduit is associated with the equipment.
- .3 Provide conduit for all electric service distribution and branch circuit conductors except armoured cable, and bus duct and except for applications where duct, cable tray and similar raceway material is provided.
- .4 Conduit for branch circuit and distribution conductors, except as noted hereinafter, shall be as specified in Article #2.01, Item .1 above.
- .5 From 1200mm above the ground floor slab.
  - .1 Conduit for branch circuit conductors concealed in masonry work in drywall, in shafts and furring's above ground;
  - .2 For branch circuit conductors exposed inside the building; and
  - .3 For distribution and branch circuit conductors concealed in poured concrete work above ground (not on grade); shall be as specified in Article #2.01 Item .2 above.
- .6 Conduit for short branch circuit connections to motorized equipment (minimum length 450mm; maximum length 600mm with 180 degree loop where possible) shall be as specified in Article #2.01, Item .3 above.
- .7 Conduit for short branch circuit connections to electric heating units where 90°C rated conductors are required (minimum length 450mm - maximum length 600mm with 180 degree loop where possible) and at points where distribution and/or branch circuit conductors cross building expansion joints shall be as specified in Article #2.01, Item .4 above.
- .8 Conduit for distribution and branch circuit conductors underground and for distribution and branch circuit conductors in special corrosive areas as defined herein shall be as specified in Article #2.01, Item .5 above.
- .9 Conduit for branch circuit conductors where concealed in walls or encased in concrete shall be as specified in Article #2.01 Item 6 above.
- .10 Conduits supplying equipment classified as explosion proof (i.e., fuel pumps and associated and adjacent equipment) shall be rigid galvanized steel for their entire length from their power source. Provide all required seals as specified in OESC.
- .11 Provide a separate ground conductor in all conduits.
- .12 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Protect conduit from concrete and water penetration during the concrete pour.

- .13 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with "Ontario Electrical Safety Code" requirements by means of galvanized pipe straps, conduit clips, ring bolt type hangers, or by other manufactured devices. Support multiple mixed size metal conduit runs with conduit racks spaced to suit spacing requirements of the smallest conduit in the group.
- .14 Install conduit parallel or perpendicular to building lines.
- .15 Generally, conduit is sized on the drawings. Conduit not sized on the drawings shall be sized in accordance with the latest edition of the Ontario Electrical Safety Code. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with the Ontario Electrical Safety Code. Where conductor sizes are increased to suit voltage drop requirements, increase the scheduled or specified conduit size to suit.
- .16 Increase conduit sizes for heavily insulated conductors (i.e., "TWU"), a minimum of one (1) conduit size, regardless of the size indicated or required.
- .17 The maximum allowable size of conduit for installation in poured concrete work must be determined in consultation with the Consultant prior to installation. The placement of reinforcing steel in structural concrete work will take precedence over the placement of conduit. Multiple runs of conduit in poured concrete work must be adequately spaced as directed by the Consultant.
- .18 Do not install horizontal runs of conduit in masonry walls.
- .19 Ensure that all conduit systems which are left empty are clean, clear, capped and properly identified. Provide suitable fish wires in all such conduit.
- .20 Provide a minimum of two (2) 25mm diameter spare conduits up to and into ceiling spaces from flush mounted panelboards located below and/or near a hung ceiling.
- .21 Support and secure surface mounted and suspended rigid PVC plastic conduit with hangers and supports as specified above for metal conduit but at support spacing in accordance with the conduit manufacturer's published recommendations.
- .22 Support all conduit installed underground on well tamped flat bed of earth, free from rocks or protrusions of any kind.
- .23 Conduit fittings shall be, unless otherwise noted, constructed of the same material as the conduit and suitable in all respects for the application.
- .24 Provide proper adaptors for joining conduits of different materials.
- .25 Ends of all site cut conduit must be square and properly reamed.

- .26 All conduits for high voltage cable installation shall be rigid galvanized steel.
- .27 Electrical conductors supplying all equipment connected to a source of emergency supply shall be installed in service spaces that do not contain other combustible material or shall be protected against exposure to fire as allowed by the Building Code. Provide fire rated enclosures to ensure continued operation for a minimum period of 2 hours from the source of power supply to the branch circuit supplying the equipment.
- .28 Use of Pyrotenax or approved equal Mineral Insulated copper sheathed cables is an acceptable alternative to providing a fire rating around conduit and cable.

### 3.02 INSTALLATION OF OUTLET BOXES

- .1 Provide an outlet box for each lighting fixture, wiring device, telephone outlet and any other outlet specified herein or shown or specified on the drawings, unless otherwise noted.
- .2 Generally, mounting heights and locations for outlets are shown on the drawings and/or specified herein, however, confirm the exact location and arrangement of all outlets with the Consultant prior to roughing-in. Architectural drawings and the Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
- .3 Do not install outlet boxes "back-to-back" in walls and partitions. Such outlets must be staggered and sealed against noise transmission. "Thru-Wall" type outlet boxes will not be permitted for any application.
- .4 Support and secure boxes independent of the conduit or cable connected thereto.
- .5 All recessed outlet boxes for surface mounted devices or lighting fixtures must be totally concealed by the device or fixture.

### 3.03 INSTALLATION OF PULLBOXES AND JUNCTION BOXES

- .1 Provide pullboxes in conduit systems wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30m in length, or with more than two (2) 90 degree bends shall be equipped with a pullbox installed at a convenient and suitable intermediate location.
- .2 Provide a junction box wherever required and where shown and/or specified on the drawings.
- .3 All pullboxes and junction boxes must be accessible after the building is completed.
- .4 Accurately locate and identify all concealed pullboxes and junction boxes on "as-built" record drawings.
- .5 Support and secure all boxes independent of the conduit or cable connected thereto.
- .6 Install identification labels indicating system name on all pullboxes and junction boxes.

END OF SECTION 26 05 33

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Common Work Results for Electrical and all documents referred to therein.

**1.02 SUMMARY**

- .1 Section Includes:
  - .1 Dry type transformers with ratings up to 1000 kVA three-phase and voltage class up to 600 Volt.

**1.03 REFERENCES**

- .1 National Electrical Manufacturers Association (NEMA)

**1.04 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Division 01 "General Requirements.
- .2 Include:
  - .1 Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.
  - .2 Technical data:
    - .1 kVA rating.
    - .2 Primary and secondary voltages.
    - .3 Frequency.
    - .4 Three-phase.
    - .5 Polarity or angular displacement.
    - .6 Full load efficiency.
    - .7 Regulation at unity pf.
    - .8 Insulation type.
    - .9 Sound rating.

**1.05 CLOSE-OUT SUBMITTALS**

- .1 Provide operation and maintenance data for dry type transformers for incorporation into manual as specified.
- .2 Operation and maintenance instructions to include:
  - .1 Tap changing.
  - .2 Recommended environmental conditions.
  - .3 Recommended periodic inspection and maintenance.

**1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Store transformers indoors in dry location.

**1.07 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

PART 2 - PRODUCTS

2.01 TRANSFORMER CHARACTERISTICS

- .1 Transformer shall be sized as per contract documents, 3 phase, 3 coils with common core construction, 60 Hz.
- .2 Primary winding shall be 600 volts, 3-phase, delta connected, complete with two full capacity 4.5% adjustment taps, 1 below (FCBN) and 1 above (FCAN) the rated voltage for 10 kVA and less and four full capacity 2.5% adjustment taps, 2 below (FCBN) and 2 above (FCAN) the rated voltage for more than 10 kVA.
- .3 Secondary winding shall be 208Y/120, volts 3-phase, wye connected with a 30° angular displacement (lagging) with respect to the primary winding.
- .4 All winding conductors shall be of copper.
- .5 Temperature rise at full load shall not exceed 80°C with a class 220 insulation system.
- .6 Standard impedance at 60Hz.
- .7 Standard audible sound level.
- .8 Windings shall be wound with the secondary winding nearest to the core and shall be round coils.
- .9 The core shall be constructed of high grade, grain oriented silicon steel laminations.
- .10 The impregnation process for the core and coil assembly shall include a period under vacuum, followed by pressure impregnation using epoxy resin (EVI process).
- .11 The transformer shall be isolated from the enclosure to reduce noise and vibration by means of anti-vibration pads.
- .12 The transformer enclosure shall be fabricated from sheet steel and shall be Type 2 (drip-proof).
- .13 The enclosure coating shall be grey ASA 61 and suitable for indoor/outdoor use.
- .14 Transformer and enclosure shall be built as per the latest energy codes.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Locate, install and ground transformer[s] in accordance with manufacturer's instructions.
- .2 Set and secure transformers in place, rigid plumb and square.
- .3 Connect primary terminals to high voltage circuit.
- .4 Connect secondary terminals to secondary feeder.
- .5 Use flexible conduit to make connections to transformer.
- .6 Energize transformers and check secondary no-load voltage.
- .7 Adjust primary taps as necessary to produce rated secondary voltage at no-load.

- .8 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

END OF SECTION 26 12 16

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.
- .2 The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of EEMAC and CSA.

1.02 WORK INCLUDED

- .1 Provide all panelboards as specified and shown for a complete installation, as required by the contract documents.

1.03 SUBMITTALS

- .1 Submit shop drawings showing the following information:
  - .1 Breaker layout drawing with dimensions indicated and nameplate designation.
  - .2 Component list.
  - .3 Conduit entry/exit locations.
  - .4 Assembly ratings including:
    - .1 Short circuit rating.
    - .2 Voltage
    - .3 Continuous current
  - .5 Cable terminal sizes.
- .2 Where applicable, the following additional information shall be submitted:
  - .1 Key interlock scheme drawing and sequence of operations.

1.04 QUALIFICATIONS

- .1 The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers and fusible switches.
- .2 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.05 ACCEPTABLE MANUFACTURERS

- .1 Schneider Canada, Cutler Hammer, ABB, and Siemens.

PART 2 - PRODUCTS

2.01 RATINGS



- .1 Panelboards shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
- .2 Panelboards shall be labelled with a CSA short circuit rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the CSA series ratings including:
  - .1 Size and type of upstream device.
  - .2 Branch devices that can be used.
  - .3 CSA series short circuit rating.
- .3 Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts and 14,000 amperes symmetrical at 600 volts.

## 2.02 CONSTRUCTION

- .1 Interiors shall be completely factory assembled with bolt-on devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- .2 Trims for lighting and appliance panelboards shall have doors with concealed hinges over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi-flush cylinder lock and catch assembly. Trim fastening screws shall not be visible.
- .3 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
- .4 Surface trims shall be same height and width as box. Flush trims shall overlap the box by one (1) inch on all sides.
- .5 A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
- .6 All locks shall be keyed alike.

## 2.03 BUS

- .1 Main bus bars shall be plated aluminium sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
- .2 Full-size insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

## 2.04 POWER DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

- .1 Power distribution panelboards and the devices contained therein shall have series interrupting ratings as indicated on the drawings. Panelboards shall have molded case circuit breakers as indicated below.
- .2 Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics. Ground fault protection shall be provided where indicated.
- .3 Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-centre switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
- .4 Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
- .5 Where indicated, circuit breakers shall be CSA listed for series rating.
- .6 Where indicated, circuit breakers shall be current limiting.
- .7 Circuit breakers 400 ampere frame and below shall be thermal-magnetic trip units and inverse time-current characteristics.
- .8 Circuit breakers 600 ampere through 1200 ampere frame shall be microprocessor-based RMS sensing electronic trip units and the following features:
  - .1 Each molded case circuit breaker microprocessor-based tripping system shall consist of three current sensors, a trip unit, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when pre-determined trip levels and time delay settings are reached.
  - .2 Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed or adjustable as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
  - .3 The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.
  - .4 When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes. Provide neutral ground fault current sensor for four wire loads.
  - .5 System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:
    - .1 Adjustable long time pick-up and delay
    - .2 Adjustable short time pick-up and delay, with selective curve shaping
    - .3 Adjustable instantaneous pick-up
    - .4 Adjustable ground fault pick-up and delay, with selective curve shaping.
- .9 Where indicated, provide circuit breakers CSA listed for application at 100% of their continuous ampere rating in their intended enclosure.

- .10 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

## 2.05 BRANCH CIRCUIT PANELBOARDS

- .1 The Minimum Integrated Short Circuit Rating for branch circuit panelboards shall be indicated on the drawings. Panelboards shall be similar and approved equal to Square D type NF or NQOD. Panelboards shall have circuit breakers as indicated below.
- .2 Bolt-in type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
- .3 Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100 ampere frame and through 100 ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be CSA listed as type SWD for lighting circuits.
  - .1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management and control system (EMCS) panels and fire alarm panels.

## 2.06 ENCLOSURE

- .1 Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the Canadian Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
- .2 Enclosures shall be provided with one (1) blank end and one end with knock-outs.
- .3 All enclosures shall be EEMAC 1 c/w drip shield for surface-mounted enclosure unless otherwise noted.

## 2.07 NAMEPLATES

- .1 Provide an engraved nameplate for each panel section.

## 2.08 FINISH

- .1 Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of grey ANSI 49 paint applied.
- .2 Suite panel shall have WHITE finish.

## PART 3 - PART 3 – EXECUTION

### 3.01 FACTORY TESTING

- .1 The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of EEMAC and CSA standards.

### 3.02 INSTALLATION

- .1 The Electrical Trade Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

### 3.03 FIELD SETTINGS

- .1 The Electrical Trade Contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operation condition. The settings shall be in accordance with the approved protective device co-ordination study or as directed by the Consultant.

END OF SECTION 26 24 16

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Provide all fuses for a complete installation, as required by the contract documents.

**1.03 SUBMITTALS**

- .1 Submit shop drawings of all fuses required.

**1.04 ACCEPTABLE MANUFACTURERS**

- .1 Ferraz Shawmut, Bussman and Little Fuse.

**PART 2 - PRODUCTS**

**2.01 FUSES**

- .1 For services up to 600 volts and up to and including 600 amps, provide HRCI-J (AJT) time delay fuses for motor and transformer circuits.
- .2 All remaining fuses up to 600 volts and up to and including 600 amps, shall be HRCI-J (CJ) fast acting fuses.
- .3 For services up to 600 volts and over 600 amps, provide class L-HRC (CL) fuses.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF FUSES**

- .1 Install fuses in all fuse holders to suit design requirements.
- .2 Provide three (3) spare fuses of each type and size used above 600 amp and six (6) spare fuses for each type and size up to and including 600 amps. Mount the spare fuses in clips neatly arranged and labelled in a suitably sized type "D" cabinet in the main electrical room.

END OF SECTION 26 28 13

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Provision, and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Provide enclosed switches, fused and/or unfused, for a complete installation, as required by the contract documents.

**1.03 SUBMITTALS**

- .1 Submit shop drawings of enclosed switches.

**1.04 ACCEPTABLE MANUFACTURERS**

- .1 Schneider Canada, Cutler Hammer, ABB, and Siemens.

**PART 2 - PRODUCTS**

**2.01 ENCLOSED SWITCHES (DISCONNECTS)**

- .1 Provide heavy duty, CSA approved enclosed switches.
- .2 Each enclosed switch shall be front operated with a handle suitable for padlocking in the "OFF" position and arranged so that the enclosure cover cannot be opened while the handle is in the "ON" position. Operating mechanisms shall be quick-make, quick-break, positive acting with visible blades and a line terminal shield.
- .3 Fusible units shall be complete with fuse clips suitable for HRC, Class "J" fuses unless otherwise noted. Each unit shall also be equipped with solderless lugs and a front cover nameplate identifying the catalogue number and electrical characteristics.
- .4 Enclosures shall be, unless otherwise noted, NEMA 1 general purpose enclosures and NEMA 3 weatherproof enclosures. Provide NEMA 4X around the cooling towers.
- .5 The ampere rating, number of poles and fuse requirements for enclosed switches shall be as specified on the documents.
- .6 Where the enclosed switch is for use on a hydraulic elevator application, such switches shall be provided with auxiliary contacts. These contacts shall be Commander positive action switches or equivalent.
- .7 Where the enclosed switch is for use on a variable frequency drive application, such switches shall be heavy duty type complete with auxiliary contacts, to wire remote stop to variable frequency drive.

PART 3 - EXECUTION

3.01 INSTALLATION OF ENCLOSED SWITCHES (DISCONNECTS)

- .1 Provide disconnects:
  - .1 Wherever shown on the drawings and/or specified herein.
  - .2 Wherever required by starter schedule drawings:
  - .3 For motorized equipment which cannot be seen from the motor starter location or is more than 10m away from the starter location.
  - .4 For all "packaged" equipment supplied by other Divisions and fed from a motor starter panel.
- .2 Enclosures mounted indoors and not exposed to the weather shall be NEMA 1 type.
- .3 Enclosures mounted outdoors or in locations exposed to the weather shall be NEMA 3 type.
- .4 Where the enclosed switch is for use on a variable frequency drive application, wire the normally closed contact on the switch to the stop circuit on the variable frequency drive.

END OF SECTION 26 28 23