Fort McMurray Airport Authority

Fort McMurray Airport
Rental Car Wash/ QTA Facility

Issued for Tender Submission
Project No.: 60723990
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PROJECT MANUAL

Outline Specification

Delivering a better world

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS		**DISCIPLINE**
Section 00 00 00	Title Page	AECOM
Section 00 01 10	Table of Contents	AECOM

DIVISION 01 – GENERAL REQUIREMENTS

Section 01 11 00	Summary of Work	
Section 01 14 00	Work Restrictions	
Section 01 20 00	Prices	
Section 01 25 00	Substitution Procedures	
Section 01 29 00	Payment Procedures	
Section 01 31 13	Project Coordination	
Section 01 31 19	Project Meetings	
Section 01 31 46	Field Engineering	
Section 01 32 00	Construction Progress Documentation	
Section 01 32 16	Construction Progress Schedule	
Section 01 33 00	Submittal Procedures	
Section 01 35 27	Special Procedures - Airport Facilities	
Section 01 35 29	Health and Safety Procedures	
Section 01 35 56	Traffic Control Procedures	
Section 01 40 00	Quality Requirements	
Section 01 41 00	Regulatory Requirements	
Section 01 50 00	Temporary Facilities and Controls	
Section 01 56 00	Temporary Barriers and Enclosures	
Section 01 57 00	Temporary Environmental Controls	
Section 01 57 13	Temporary Erosion and Sediment Controls	
Section 01 61 00	Common Product Requirements	
Section 01 73 00	Execution Requirements	
Section 01 74 00	Cleaning and Waste Processing	
Section 01 75 00	Closeout Testing Requirements	
Section 01 77 19	Closeout Requirements	
Section 01 78 00	Closeout Submittals	
Section 01 78 36	Warranties	
Section 01 79 00	Demonstration and Training	
Section 01 91 13	General Commissioning	

DIVISION 03 – CONCRETE		**DISCIPLINE**
Section 03 10 00	Concrete Formwork and Falsework	S
Section 03 20 00	Concrete Reinforcing	S
Section 03 30 00	Cast-in-Place Concrete	S
Section 03 35 00	Concrete Finishing	A

DIVISION 04 – MASONRY		**DISCIPLINE**
Section 04 05 00	Common Work Results for Masonry	S

DIVISION 04 – MASONRY		**DISCIPLINE**
Section 04 05 13	Masonry Mortar and Grouting	S
Section 04 05 19	Masonry Anchorage and Reinforcing	S
Section 04 22 00	Concrete Masonry Units	A

DIVISION 05 – METALS		**DISCIPLINE**
Section 05 12 23	Structural Steel for Buildings	S
Section 05 21 00	Steel Joist Framing	S
Section 05 31 00	Steel Decking	S
Section 05 50 00	Metal Fabrications	A
Section 05 51 13	Steel Railings	A

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES		**DISCIPLINE**
Section 06 10 00	Rough Carpentry	A
Section 06 20 00	Finish Carpentry	A
Section 06 64 13	Fiber Reinforced Plastic (FRP) Wall Paneling	A

DIVISION 07 – THERMAL AND MOISTURE PROTECTION		**DISCIPLINE**
Section 07 13 52	Bituminous Sheet Membrane Waterproofing	A
Section 07 14 16	Cold Fluid-Applied Waterproofing	A
Section 07 18 13	Pedestrian Traffic Coatings	A
Section 07 18 16	Vehicular Traffic Coatings	A
Section 07 21 00	Thermal Insulation	A
Section 07 27 13	Air and Vapour Barriers	A
Section 07 42 16	Aluminum Plate Panels	A
Section 07 52 16	SBS Modified Bituminous Membrane Roofing	A
Section 07 62 00	Prefinished Metal Flashing and Trim	A
Section 07 71 00	Roofing Specialties	A
Section 07 72 33	Roof Hatches and Accessories	A
Section 07 84 00	Firestopping and Smokeseals	A
Section 07 92 00	Joint Sealants	A

DIVISION 08 – OPENINGS		**DISCIPLINE**
Section 08 11 13	Steel Doors and Frames	A
Section 08 11 16	Aluminium Doors and Frames	A
Section 08 36 16	Sectional Overhead Insulated Metal Doors	A
Section 08 44 13	Glazed Aluminum Curtain Wall	A
Section 08 71 00	Door Hardware	A
Section 08 80 00	Glazing	A
Section 08 90 00	Fixed Metal Louvres	A

DIVISION 09 – FINISHES		**DISCIPLINE**
Section 09 30 00	Tiling	A

DIVISION 09 – FINISHES		**DISCIPLINE**
Section 09 51 13	Acoustical Ceilings	A
Section 09 65 00	Resilient Flooring	A
Section 09 90 00	Painting	A
Section 09 96 56	Epoxy Coatings	A

DIVISION 10 – SPECIALTIES		**DISCIPLINE**
Section 10 14 53	Traffic Signage	A
Section 10 28 13	Washroom and Custodial Accessories	A
Section 10 44 00	Fire Protection Specialities	A
Section 10 91 13	Miscellaneous Specialties	A

DIVISION 11 – EQUIPMENT		**DISCIPLINE**
Section 11 12 00	Parking and Traffic Control Equipment	A

DIVISION 22 – PLUMBING		**DISCIPLINE**
Section 22 05 00	Common Work Results for Plumbing	M
Section 22 05 15	Plumbing Specialities and Accessories	M
Section 22 07 19	Plumbing Piping Insulation	M
Section 22 11 16	Domestic Water Piping	M
Section 22 13 16.16	Sanitary Waste and Venting Piping-Plastic	M
Section 22 42 13	Commercial Washroom Fixtures	M

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)		**DISCIPLINE**
Section 23 01 31	Air Duct Cleaning for HVAC Systems	M
Section 23 05 00	Common Work Results for HVAC	M
Section 23 05 13	Common Motor Requirements for HVAC Equipment	M
Section 23 05 15	Common Installation Requirements for HVAC Pipework	M
Section 23 05 16	Expansion Fittings and Loops for HVAC Piping	M
Section 23 05 17	Pipe Welding	M
Section 23 05 19	Meters and Gauges for HVAC Piping	M
Section 23 05 19.13	Thermometers and Pressure Gauges- Piping Systems	M
Section 23 05 23.01	Valves- Bronze	M
Section 23 05 29	Hangers and supports for HVAC Piping and Equipment	M
Section 23 05 48	Vibration and Seismic Controls for HVAC	M
Section 23 05 53	Identification for HVAC Piping and Equipment	M
Section 23 05 93	Testing, Adjusting and Balancing for HVAC	M
Section 23 05 94	Pressure Testing of Ducted Air systems	M
Section 23 07 13	Duct Insulation	M
Section 23 07 19	HVAC Piping Insulation	M
Section 23 08 13	Performance Verification HVAC Systems	M
Section 23 08 16	Cleaning and Start-Up of HVAC Piping Systems	M

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)		**DISCIPLINE**
Section 23 09 33	Electric and Electronic Control System for HVAC	M
Section 23 21 13.01	Hydronic Systems- Copper	M
Section 23 21 16	Hydronic Piping Specialties	M
Section 23 21 23	Hydronic Pumps	M
Section 23 23 00	Refrigerant Piping	M
Section 23 25 00	HVAC Water Treatment	M
Section 23 31 13.01	Metal Ducts-Low Pressure to 500Pa	M
Section 23 33 00	Air Duct Accessories	M
Section 23 33 14	Dampers -Balancing	M
Section 23 33 15	Dampers-Operating	M
Sections 23 33 16	Dampers-Fire and Smoke	M
Sections 23 33 46	Flexible Ducts	M
Section 23 34 00	HVAC Fans	M
Section 23 37 13	Diffusers, Registers and Grilles	M
Section 23 37 20	Louvers, Intakes and Vents	M
Section 23 51 00	Breechings Chimneys and Stacks	M
Section 23 52 00	Heating Boilers	M
Section 23 72 00	Air-To-Air Energy Recovery Equipment	M
Section 23 74 00	Packaged Outdoor HVAC Equipment R0	M
Section 23 82 36	Finned Tube Radiation Heaters	M
Section 23 83 16	Radiant Heating Hydronic Piping	M

DIVISION 25 – INTERGRATED AUTOMATION		**DISCIPLINE**
Section 25 01 11	EMCS: Start-Up, Verification and Commissioning	M
Section 25 01 12	EMCS: Training	M
Section 25 05 01	EMCS: General Requirements	M
Section 25 05 02	EMCS: Submittals and Review Process	M
Section 25 05 03	EMCS: Project Record Documents	M
Section 25 05 54	EMCS: Identification	M
Section 25 05 60	EMCS: Field Installation	M
Section 25 08 20	EMCS: Warranty and Maintenance	M
Section 25 30 01	EMCS: Building Controllers	M
Section 25 30 02	EMCS: Field Control Devices	M
Section 25 90 00	Integrated Automation Control Sequences	M

DIVISION 26 – ELECTRICAL		**DISCIPLINE**
Section 26 05 00	Common Work Results for Electrical	E
Section 26 05 20	Wire and Box Connectors (0-1000 V)	E
Section 26 05 21	Wires and Cables (0-1000 V)	E
Section 26 05 22	Connectors and Terminations	E
Section 26 05 28	Grounding: Secondary	E

DIVISION 26 – ELECTRICAL		**DISCIPLINE**
Section 26 05 29	Fastenings and Supports	E
Section 26 05 31	Splitters, Junction Boxes and Fittings	E
Section 26 05 32	Boxes and Fittings	E
Section 26 05 33.01	Surface and Lighting Fixture Raceways	E
Section 26 05 33	Raceway and Boxes for Electrical Systems	E
Section 26 05 34	Conduits	E
Section 26 05 43	Concrete Encased Duct Banks	E
Section 26 09 24	Lighting Control Devices: Photoelectric	E
Section 26 24 14	Switchboards	E
Section 26 24 16	Panel Boards: Breaker Type	E
Section 26 27 13	Electrical Digital Metering	E
Section 26 27 26	Wiring Devices	E
Section 26 28 16.02	Moulded Case Circuit Breakers	E
Section 26 36 13.01	Manual Transfer Switches	E
Section 26 43 13	Surge Suppression Devices	E
Section 26 50 00	Lighting	E
Section 26 52 00.01	Lighting - Central Emergency System	E
Section 26 52 13.16	Exit Signs	E
Section 26 60 00	Generator Connection Box Specs	E

DIVISION 27 – COMMUNICATIONS		**DISCIPLINE**
Section 27 05 28	Pathways for Communications Systems	E
Section 27 10 05	Structured Cabling for Communications Systems	E

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY		**DISCIPLINE**
Section 28 13 00	Access Control	E
Section 28 23 00	CCTV Video Surveillance	E
Section 28 31 00	Intrusion Detection Systems	E
Section 28 46 00	Fire Detection	E
Section 28 46 21	Fire Alarm Systems	E

DIVISION 32 – EXTERIOR IMPROVEMENTS		**DISCIPLINE**
Section 32 31 13	Chain Link Fencing and Gates	A

EARTHWORK AND EXTERIOR IMPROVEMENTS WORKS

Appendix 1	Latest version and Addenda of Standard Construction Specifications by Regional Municipality of Wood Buffalo. *https://www.rmwb.ca/en/permits-and-development/resources/Documents/Engineering-Servicing-Standards/Standard-Construction-Specifications.pdf*

EARTHWORK AND EXTERIOR IMPROVEMENTS WORKS

Appendix 2 Latest version and Addenda of Engineering Servicing Standards and Development by Regional Municipality of Wood Buffalo.

https://www.rmwb.ca/en/permits-and-development/resources/Documents/Engineering-Servicing-Standards/Engineering-Servicing-Standard---March-2021.pdf

END OF TABLE OF CONTENTS

1 General

1.1 DESCRIPTION OF WORK

.1 Work of this Contract comprises of project description as outlined in the Contract Documents and including but not limited to items listed below.

.2 The Work of this Contract is to provide labour, products, equipment, material, and services necessary to complete the construction of the new Rental Car Wash QTA Facility and addition of surrounding site work and associated work at the Fort McMurray Airport Authority (FMAA) property as indicated in the Contract Documents and that will include but not limited to the following:

- .1 Main building:
  - .1 Three wash bays (with potential of adding fourth wash bay, including:
    - .1 Car wash and dryer equipment.
    - .2 Rapid roll up doors to minimize energy loss.
    - .3 Exterior heated driveway at the wash bay exits.
      - .1 Prevent washed car from freezing of water.
  - .2 Services and storage including:
    - .1 Four storage rooms for each wash bays.
    - .2 Two universal washrooms.
    - .3 Janitorial equipment storage room.
    - .4 Mechanical room.
    - .5 Electrical room.
    - .6 Communication and IT room for security and network equipment.
- .2 Other site facilities:
  - .1 One single fuel station with double hose for gas and diesel.
  - .2 One waste transfer enclosure.
  - .3 Parking Area:
    - .1 8 to 10 staff parking spaces (including 2 barrier free parking).
  - .4 Staging Area:
    - .1 4 staging bays (including 10 stalls in each bay)
  - .5 One transformer.
  - .6 Site parameters include:
    - .1 one automated entry gate for the staff and rental cars.
    - .2 one manually operated gate for service trucks.
    - .3 one exit gate.
  - .7 Landscaped and Snow Maintenance equipment storage areas.

.3 Division of the Work among Subcontractor's suppliers or vendors is solely the Contractors responsibility. Neither the FMAA Project Manager nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

1.2 THE CONTRACT DOCUMENTS

.1 Work will be performed under one Contract; the Contract will be in the form of the Agreement between FMAA and Contractor, Canadian Standard Construction Document, CCDC 2, Stipulated Price (Lump Sum) Contract as amended by the Supplementary Conditions.

.1 Construct the Work under Lump Sum Contract

.2 Supply the FMAA with a breakdown of any lump sum price in excess of $100,000.

.3 Provide lump sum amount for the entire Contract with separate breakdown.

.4 Where unit rates are requested as part of the Bid Form: unless otherwise provided by the bidder, the unit rates shall be applicable as additional costs for work that is added to the scope as well as credit prices for work that is eliminated from the scope.

.5 The Work under the Contract must be coordinated at any time with Airport Operations Control Centre (AOCC).

.6 The Work under the Contract shall be governed by safety regulations acceptable to FMAA safety officers.

.2 Division 1 General Requirements, of the Specification generally specify work and coordination of the work that is the direct responsibility of the Contractor but shall not be interpreted to define absolutely the limits of responsibility that must be established between the Contractor and his Subcontractors by their separate agreements.

.3 Ensure that Subcontractors understand that the General Conditions of the Contract, and Division 1 General Requirements, apply to Sections of the Specification governing their work.

.4 Ensure that the work includes all labour, equipment and products required, necessary or normally recognized as necessary for the proper and complete execution of the work of each trade.

.5 Work in this Specification is divided into descriptive Sections which are not intended to identify absolute contractual limits between Subcontractor, nor between the General Contractor and his Subcontractors. The Contractor shall organize division of labour and supply of materials essential to complete the Project in all its parts and provide a total enclosure and protection from weather of interior spaces, as established in the General Conditions of the Contract.

.6 As a result, the Consultant shall not be required to decide on questions arising with regard to agreements or contracts between the Contractor and Subcontractors or Suppliers, nor to the extent of the parts of the Work assigned thereto.

.7 Further, no extra will be allowed as a result of the failure to coordinate and allocate the Work such that the Work is Provided in accordance with the Contract Documents.

.8 Wherever the word "building" occurs in the Contract Documents it shall be taken to mean all the buildings included in the Contract.

.9 Wherever in the Contract Documents the words "approval", "approved", "direction", "directed", "selection", "selected", "request", "requested", "report", and similar words are used, such approvals, directions, selections, requests and reports shall be given by the Consultant in writing unless specifically stated otherwise.

.10 Wherever in the Contract Documents the word "supply" is used in any form, it shall mean that the work specified to be supplied includes delivery to site and unloading at location directed.

.11 Wherever in the Contract Documents the word "installed" issued in any form, it shall mean that the work specified for installation includes uncrating, unpacking, etc.; moving from stored location to place of installation; and installing to meet specified requirements.

.12 Wherever in this Specification it is specified that work is to proceed or to meet approval, direction, selection or request of authorities having jurisdiction or others, such approval, direction, selection or request shall be in writing.

.13 Wherever in this Specification or as directed by the Consultant it is specified that work shall be repaired, made good or replaced, it shall be performed without any additional cost to the FMAA.

.14 Whenever in the Specifications the term "and/or" is used, the Consultant shall decide which of the possible meanings, to be derived at from the sentence where this term occurs shall govern.

1.3 DIVISION 1. GENERAL REQUIREMENTS

.1 The provisions of all Sections of Division 01 shall apply to each Section of this Contract.

1.4 STANDARDS AND CODES

.1 Contract forms, codes, specifications, standards, manuals and installation, application and maintenance instructions referred to in these specifications, unless otherwise specified, amended or date suffixed, shall be latest published editions at Contract date.

1.5 LAWS, NOTICES, PERMITS AND FEES

.1 Comply with codes, by-laws, and regulations of authorities having jurisdiction over the Place of the Work. Codes and regulations form an integral part of the Contract Documents.

.2 Permits:

.1 The Contractor shall obtain and pay for all permits, licenses, deposits and certificates of inspection as part of the Work, including permits for road closures.

.2 The FMAA Project Manager has initiated the permit application process for the following, but responsibility for completing the application process, including all associated costs and responsibilities, rests with the Contractor and is included as part of the Work:

.1 Refer also to Section 01 35 56 – Traffic Control Procedures for permits required for road closure (Temporary Street Occupation Permit).

.3 Obtain permits required to execute work on municipal rights of way. Obtain damage deposits for sidewalks, roads and services, unless otherwise indicated.

.3 Arrange for inspection, testing and acceptance of the Work required by the authorities having jurisdiction. Be responsible for necessary preparations, provisions and pay costs.

.4 It is the responsibility of the Contractor to schedule notifications and inspections required by authorities having jurisdiction such that notifications can be properly received and that inspections can be properly undertaken without causing a delay in the Work. The Contractor, at no additional cost to FMAA, shall be solely responsible for any delay in the Work caused by failure to properly schedule required notifications and inspections.

1.6 DISCREPANCIES AND CLARIFICATIONS

.1 Advise Consultant of discrepancies discovered in requirements of the Contract Documents and request clarification from Consultant in written form.

.2 Advise Consultant when clarifications are required pertaining to meaning or intent of requirements of Contract Documents and request clarification from Consultant in written form.

.3 Do not proceed with related work until written clarification is provided by Consultant.

.4 Failure to notify Consultant shall result in Contractor incurring responsibility for resulting deficiencies and expense at no additional cost to FMAA.

.5 Written instructions issued by Consultant for the purpose of clarification, implicitly supersede applicable and relevant aspects of the Contract Documents irrespective of whether or not these documents are explicitly or specifically cited in clarification requests or clarification instructions.

.6 For discrepancies between specifications and drawings, the most stringent item shall be provided in the tender.

1.7 WORK PERFORMED UNDER SEPARATE CONTRACTS

.1 Work not to be included in the Contract, as noted "NIC" on the Drawings, shall be governed by FMAA and Other Contractors, of the General Conditions.

1.8 WORK BY OWNER

.1 Permit the Owner and/or their contractors to inspect the work at any reasonable time, and to perform such work and install such equipment as the Owner may require.

.2 Work to be performed by FMAA Forces, including, but not limited to the follow:

.1 Contract Number and Title

.2 Scope

.3 Schedule (Start date, milestones, completion date, etc.)

.3 Services to be provided by Contractor, including but not limited to the follow:

.1 Access, work area, laydown area, power, water, sanitary facilities, etc.

1.9 WORK BY OTHERS

.1 Concurrent Contract(s) With Work Under the Contract, coordinate activities to minimize interference with the work of Other Contractors and FMAA Workers.

.2 In order to complete the Projects in a timely manner, Other Contractors do or will do work with their own forces. The Contractor will co-operate with the Other Contractors and FMAA in performing the Work required to complete the Projects in a timely and efficient manner. In cases of conflict between the sequence of Works to be performed by the various parties, the decision of FMAA will be final.

.3 Work Is Performed by Other Contractors, including, but not limited to the follow:

.1 Contract Number and Title

.2 Scope

.3 Schedule (Start date, milestones, completion date, etc.)

.4 Services to be provided by Contractor, including but not limited to the follow:

.1 Access, work area, laydown area, power, water, sanitary facilities, etc.

1.10 CONSTRUCTION PROGRESS SCHEDULE

.1 Meet with FMAA Project Manager and Consultant within five (5) working days of Contract award, to discuss proposed approach for undertaking the Work, inclusive of methodology, sequencing, Construction Equipment, and labour resources to be utilized.

.2 Submit a preliminary as-planned schedule as indicated in Section 01 32 16 – Construction Progress Schedule, within fifteen (15) working days after Contract award.

.3 Once preliminary as-planned schedule is approved and the final as-planned schedule is created, record "progress to date" on a copy of schedule to be available at the Site. Inspect Work with the FMAA Project Manager and the Consultant at least bi-weekly to establish progress on each current activity.

.4 The Contractor’s schedule is to be updated and resubmitted to the Consultant as a progress schedule at least once per month, on a date to be mutually agreed by the Contractor and the Consultant

1.11 SITE PROGRESS RECORDS

.1 Maintain at site a permanent written record of progress of work. Make the record available at all times with copies provided when requested. Include in record each day:

.1 Weather conditions with maximum and minimum temperatures.

.2 Conditions encountered during excavation. Record quantities pumped for dewatering.

.3 Commencement and completion dates of the work of each trade in each area of Project.

.4 Erection and removal dates of formwork in each area of Project.

.5 Dates, quantities, and particulars of each concrete pour.

.6 Dates, quantities, and particulars of waterproofing installation.

.7 Dates, quantities, and particulars of roofing installation.

.8 Attendance of Contractor's and Subcontractor's work forces at Project and a record of the work they perform.

.9 Dates, status and particulars of submissions, i.e.. shop drawings, samples, mock-ups and the like.

.10 Dates, status and particulars of deliveries, i.e.. manufacturing dates, delivery and installation dates.

.11 Visit to site by FMAA Project Manager, Consultant, authorities having jurisdiction, testing companies, Contractor, Subcontractors, and suppliers.

.2 Maintain a progress chart in approved format. Show on chart proposed work schedule and progress of work by Contractor and Subcontractor. The status of delivery items, i.e.. shop drawings status, manufacture dates - delivery and installation dates.

1.12 DOCUMENTS AT THE PLACE OF THE WORK

.1 Maintain at the Place of the Work, one copy of each of following:

.1 Contract Documents including drawings, specifications, addenda, and other modifications to the Contract, including copies of standards and codes referenced in the Contract Documents.

.2 'Reviewed' or 'Reviewed as Modified' shop drawings. Refer to Section 01 33 00 – Submittal Procedures for details of schedules required.

.3 Construction, inspection and testing, and submittal schedules.

.4 Supplemental Instructions, proposed Change Orders, Change Orders, and Change Directives.

.5 Field Test Reports.

.6 Consultant’s field review reports and deficiency reports.

.7 Reports by authorities having jurisdiction.

.8 Building and other applicable permits, and related permit documents.

.9 Daily log of the Work.

.10 As-built drawings recording as-built conditions, instructions, changes, and the like, as called for in Section 01 33 00 – Submittal Procedures, prior to being concealed.

.2 Make above material available to Consultant upon request.

1.13 TRADEMARK AND LABELS

.1 Trademarks and labels, including applied labels, shall not be visible in finished work in finished areas, unless otherwise accepted or indicated by Consultant.

1.14 EXAMINATION

.1 Examine site, and ensure that each Section performing work related to site conditions has examined it, so that all are fully informed on all particulars which affect the Project Work (thereon and at the place of the building, and in order that construction proceeds competently and expeditiously).

.2 Ensure by examination that all physical features at the work, and working restrictions and limitations which exist are known, so that FMAA and FMAA Project Manager is not restricted in use of the premises.

.3 Previously Completed Work:

.1 Where dimensions are required for proper fabrication, verify dimensions of completed work in place before fabrication and installation of work to be incorporated with it.

.2 Verify that previously executed work and surfaces are satisfactory for installation or application, or both, and that performance of subsequent work will not be adversely affected.

.3 Ensure that work installed in an unsatisfactory manner is rectified by those responsible for its installation before further work proceeds.

.4 Commencement of work will constitute acceptance of site conditions and previously executed work as satisfactory.

.5 Defective work resulting from application to, or installation on, or incorporation with, unsatisfactory previous work will be considered the responsibility of those performing the later work.

.4 Construction Measurements:

.1 Take site dimensions of completed work before installation of work to be incorporated commences.

.2 Before commencing installation of work, verify that its layout is accurately in accordance with intent of Drawings, and that positions, levels, and clearances to adjacent work are maintained.

.3 Before commencing work, verify that all clearances required by authorities having jurisdiction can be maintained.

.4 If work is installed in wrong location, rectify it before construction continues.

.5 Where dimensions are not available before fabrication commences, the dimensions required shall be agreed upon between the trades concerned.

.6 All measurements shall be metric.

1.15 PROTECTION OF WORK, PROPERTY AND PERSONS

.1 Include in work necessary methods, materials, and construction to ensure that no damage or harm to work, materials, property and persons results from the work of this Contract. Temporary facilities relating to protection are specified in Section 01 50 00 – Temporary Facilities and Controls.

.2 Comply with all instructions and/or orders issued by authorities having jurisdiction.

.3 Ensure that compulsory wearing of hard hats and safety boots is observed by all persons employed on the work. Provide spare hard hats for visitors, refuse admission to the premises to those refusing to wear same.

.4 Keep excavations, and pits free of rainwater, ground water, backing up of drains and sewers, and all other water. Pump dry as required.

.5 Protect adjacent private and public property from damage and, if damaged, make good immediately. Make good private property to match in all details its original condition in material and finishes as approved, and public property in accordance with requirements specified and/or instructed by FMAA Project Manager or as directed by the Consultant.

.6 Keep surfaces, on which finish materials will be applied, free from grease, oil, and other contamination which would be detrimental in any way to the application of finish materials.

.7 Do not apply visible markings to surfaces exposed to view in finished state or that receive transparent finishes.

.8 Protect surfaces of completed work exposed to view from staining, disfigurement and all other damage by restriction of access or by use of physical means suitable to the material and surface location. Establish with each Subcontractor the suitability of such protection in each case.

.9 Brace and shore masonry walls until their designed lateral support is incorporated at both top and bottom, in accordance with safe construction practices.

.10 Enforce fire prevention methods at site for new work maintain existing in accordance with local authorities having jurisdiction. Do not permit bonfires, open flame heating devices or accumulation of debris. Use flammable materials only if proper safety precautions are taken, both in use and storage.

.11 Do not store flammable materials in the building. Take necessary measures to prevent spontaneous combustion. Place cloths and other disposable materials that are a fire hazard in closed metal containers and remove them from the building every night.

.12 Where flammable materials are being applied, ensure that adequate ventilation is provided, spark-proof equipment is used, and smoking and open flames are prohibited.

.13 Ensure that volatile fluid wastes are not disposed of in storm or sanitary sewers or in open drain courses.

.14 Public Utilities and Services:

.1 Verify location of and limitations imposed by, existing mechanical, electrical, telephone and similar services, and protect them from damage. If necessary, relocate active services to ensure that they function continuously wherever possible in safety and without risk of damage or down time to the existing buildings.

.2 Cap off and remove unused utility services encountered during work after approval is given by the utilities concerned or authorities having jurisdiction, which ever may apply. Relocation, removal, protection and capping of existing utility services shall be performed only by the applicable utility, and of other services by licensed mechanics.

.3 Make arrangements and pay for connection charges for services required for the Work.

.15 Ensure that precautions are taken to prevent leakage and spillage from plumbing and mechanical work that may damage surfaces and materials finished or unfinished.

.16 Give constant close supervision to roofing/waterproofing membranes following their installation, during the time they are temporarily protected or exposed, to ensure that no damage occurs to them before completion of building.

.17 Prevent spread of dust beyond the construction site by wetting, or by other approved means, as required or as directed by the Consultant and/or authorities having jurisdiction.

.18 Make good roads, soft landscaping, walkways, curbs, sidewalks, possessions and property, soiled or damaged due to the Work, to requirements of authorities having jurisdiction and requirements of and Making Good, as applicable.

1.16 EXISTING SERVICES

.1 More information is included in section 01 50 00.

.2 FMAA will NOT provide electricity for the purposes of this contract. The Contractor shall install temporary source(s) of electricity on site for the duration of the project.

.3 FMAA will NOT provide water for the purposes of this contract. The Contractor shall install temporary source(s) of electricity on site for the duration of the project.

.4 The Contractor shall plan in advance the work and make all necessary arrangements to plan and price the construction.

.5 The Contractor shall pay for any services supplied by the FMAA.

1.17 SITE CONDITIONS

.1 For the purposes of the performance of the Work, the condition of the site is deemed to be that which existed on the date of award of the Contract.

.2 Prior to the start of the Work, the Contractor shall conduct a condition inspection of the site and the immediate vicinity in the presence of the FMAA and appropriate stakeholders and Subcontractors. During the inspection and with the acknowledgement of all parties present, the Contractor shall document any changes observed. For record purposes, the FMAA may, at the time of inspection or at any other time, videotape or photograph the condition of the site.

1.18 WORK ON PUBLIC PROPERTY

.1 Include curb cuts and making good of existing property to Provide fully paved and finished approaches to requirements of authorities having jurisdiction.

.2 Include making good of existing curbs, walks, paving and soft landscaping on adjacent property.

1.19 INSERTS, ANCHORS AND FASTENINGS

.1 Include in the work of each Section necessary fastenings, anchors, inserts, attachment accessories, and adhesives. Where installation of devices is in work of other Sections, deliver devices in ample time for installation, locate devices for other Sections and co-operate with other Sections as they require.

.2 Do not install wood plugs or blocking for fastenings in masonry, concrete, or metal construction, unless specified or indicated on the drawings.

.3 Do not use fastenings which cause spalling or cracking of materials in which they are installed. Do not use powder actuated fastening devices unless specified or prior written approval is given by the Consultant for each specific use.

.4 Use only approved driven fasteners.

.5 Install metal-to-metal fastenings fabricated of the same metal or of a metal which will not set up electrolytic action causing damage to fastenings or components, or both. Use non-corrosive or galvanized steel fastenings for exterior work, and where attached to, or contained within, exterior walls and slabs. Leave steel anchors bare where cast in concrete.

.6 Install work with fastenings or adhesives in sufficient quantity to ensure permanent secure anchorage of materials, components, and equipment. Space anchors within limits of load-bearing or shear capacity.

.7 Space exposed fastenings evenly and in an organized pattern. Keep number to a minimum. Provide exposed metal fastenings of same material, texture, colour and finish as metal on which they occur.

.8 At fastenings that penetrate metal roof deck, ensure that penetrations are sealed airtight with approved sealant.

.9 Galvanize steel anchors in masonry and at exterior of building, unless otherwise specified elsewhere. Leave steel anchors bare where cast in concrete.

1.20 SMOG ALERT PROTOCOLS

.1 The Contractor shall develop and implement a set of smog alert protocols for use in the Work.

.2 The Contractor's smog alert protocols shall complement the smog alert response plan already in place for the local authorities having jurisdiction.

1.21 CLEANING

.1 Ensure that spatters, droppings, soil, labels, and debris are removed from surfaces to receive finishes before they set up. Leave work and adjacent finished work in new condition.

.2 Use only cleaning materials which are recommended for the intended purpose by both the manufacturer of the surface to be cleaned and by the cleaning material supplier.

.3 Maintain areas "broom clean" at all times during the work. Vacuum clean interior areas immediately before finish painting commences.

.4 Do not burn or bury waste material at site. Remove as often as required to avoid accumulation.

.5 Do not allow waste material and debris to accumulate in an unsightly or hazardous manner. Sprinkle dusty accumulations with water or other approved materials during removal of same.

.6 Control lowering of materials. Use as few handlings as possible. Do not drop or throw materials from storeys above grade.

.7 Ensure that cleaning operations are scheduled to avoid deposit of dust or other foreign matter or surfaces during finishing work and until wet or tacky surfaces are cured.

.8 Each Section shall supply the Contractor with instructions for final cleaning of his work, and for inclusion in Project Data Book as specified in each trade Section and in Section 01 33 00 – Submittal Procedures.

.9 Final cleaning is to be performed one (1) week prior to opening the project to the public and shall include cleaning of all work as required by each trade. Co-ordinate final cleaning with FMAA Project Manager and FMAA's maintenance staff.

1.22 ADJUSTING

.1 Ensure that all parts of work fit snugly, accurately and in true planes, and that moving parts operate positively and freely, without binding and scraping.

.2 Verify that work functions properly, and adjust it accordingly to ensure satisfactory operation.

.3 Lubricate products as recommended by the supplier.

1.23 SALVAGE

.1 Unless otherwise specified, surplus material resulting from construction, and construction debris shall become the property of Contractor, who shall dispose of it away from site.

.2 Treasure, such as coins, bills, papers of value, and articles of antiquity, discovered during digging, demolition and cutting at the site shall remain property of FMAA, and shall be delivered immediately into his custody.

1.24 SIGNAGE

.1 All site signage prior to fabrication or installation shall have written approval by the FMAA Project Manager.

.2 The Contractor shall submit to the FMAA Project Manager a layout of all required signage, show types, sizes and locations.

1.25 DRAWINGS AND SPECIFICATIONS

.1 The Contract Drawings included.

.2 Additional Drawings:

.1 Where clarification is requested, the FMAA may (but shall not be obligated to) issue additional drawings which have the same meaning and intent as if they were included in the Contract.

.3 Scaling Of Drawings:

.1 The Contractor shall not scale drawings. The Contractor acknowledges that locations of fixtures, equipment, and devices shown on the drawings are schematic only. The Contractor shall ensure that all critical dimensions and locations are calculated and individually laid out by industry-standard methods, including global positioning systems if such are appropriate to the Work. Where dimensions are not shown on the drawings, final locations for fixtures, equipment and devices shall be as determined by the FMAA.

1.26 PHASING OF THE WORK

.1 Phasing of the work shall be at the discretion of the contractor. Phasing plans must be approved but the FMAA prior to the commencement of the Work.

1.27 WARRANTY

.1 Provide warranty for repairs (material performance and workmanship) for the duration of a minimum of one (1) year (refer to 01 78 36 for further information). Where a warranty period of a duration longer than one (1) year is specified elsewhere in the Contract Documents, the longer warranty period governs.

1.28 SCHEDULE

.1 The Work of this section shall be completed in accordance with the FMAA's milestone schedule:

.1 Substantial completion date: DATE, MONTH, 2025

.2 Total performance date: DATE, MONTH, 2025

1.29 PARTIAL OCCUPANCY

.1 The Contractor shall schedule the Work to meet partial occupancy requirements of the FMAA. Each occupancy shall be completed to the stage of Substantial Performance of the Work including the acceptance of all life safety components and systems independent of another if necessary.

.2 Partial occupancy by the FMAA shall not relieve the Contractor of its obligation to warrant the Work and to rectify defects in the whole of the Work during the warranty period.

1.30 INTERRUPTION OF WORK

.1 In the event of foreseeable interruption of the Work due to Airport operational requirements, the Contractor shall take such interruptions into consideration and allow for same in the Contract Price and in the Contract schedule. Further details are set out in Section 01 14 00 – Work Restrictions

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 EXISTING SERVICES

.1 Notify FMAA Project Manager and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give FMAA Project Manager a minimum of 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum.

.3 Provide for pedestrian and vehicular traffic in accordance with Section 01 35 56 – Traffic Control Procedures and as required to FMAA guidelines.

.1 Coordinate and submit planned work to FMAA for approval prior to start the Work.

.4 Construct barriers in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.

1.2 SPECIAL REQUIREMENTS

.1 Restrictions for work involving major noise emitting activities shall be in accordance with the current FMAA construction guidelines and the requirements of authorities having jurisdiction.

.1 Major noise emitting activities shall include activities that generate noise levels above those normally generated by construction activities, such as pile driving, demolition, and the like.

.2 Notify representatives of occupied buildings adjacent to the Place of the Work, as well as the Consultant and FMAA Project Manager, a minimum of 48 hours prior to undertaking major noise emitting activities, including a description of the nature and extent of such activities. FMAA Project Manager shall provide contact information for representatives of adjacent occupied buildings to the Contractor.

.3 Coordinate and work of this contract within FMAA properties refer to Section 01 35 27 – Special Procedures: Airport in Use and the current FMAA construction guidelines.

.4 Installation of hoarding shall be coordinated with FMAA Project Manager.

.5 Required relocation of hoarding during construction shall be coordinate with FMAA Project Manager.

1.3 AIRPORT OPERATIONAL RESTRICTIONS

.1 The Contractor in his execution of the Work shall not disrupt Airport operations at any time, except as authorized by the Engineer and the Airport Construction Coordinator.

.2 The Work at the Airport shall be coordinated through the Airport Construction Coordinator. Airport construction coordinators contact:

.1 Cuyler Green cuyler.green@flyymm.com

.3 Further details are set forth in Section 01 35 27 – Special Procedures - Airports Facilities.

1.4 SECURITY RESTRICTIONS

.1 The Work shall be subject to the FMAA regulations and procedures concerning public safety and security.

.2 Conform to the requirement of the current FMAA construction guidelines, when:

.1 Work occurs in restricted areas and airside areas.

.2 Construction vehicles drive in airside areas

.3 Where security of existing facilities will be reduced by the performance of any Work, the Contractor shall provide temporary means so as to maintain required security to the satisfaction of the Construction Control Office and the Senior Manager, Security Infrastructures.

.4 Where the Work may breach the Primary Security Line, the Contractor shall provide details of the extent of the proposed breach to the Construction Control Office and the Senior Manager, Security Infrastructures for approval not less than seven (7) days prior to the requirement for such Work to commence.

.5 Where required by the Senior Manager, Security Infrastructures, the Contractor shall provide security personnel so as to maintain satisfactory security for the duration of the performance of the portion of the Work during which the Primary Security Line will be breached, until the Primary Security Line is fully restored.

.6 The cost of providing temporary security personnel shall be borne by the General Contractor; refer to section 01 21 00.

1.5 ALTERATIONS TO EXISTING FACILITIES

.1 Where the Work or a portion thereof is being performed in existing occupied buildings or different facility that are in Airport use, the Contractor shall execute the Work with the least possible interference or disturbance to the general public, tenants, Airport personnel or to the existing technological process that occur in the facility and not to impede the facility operation essential to Airport.

1.6 CONSTRUCTION PHASING

.1 Planning and staging of the Work in accordance with the Contract Documents shall be the responsibility of the Contractor. However, in order to coordinate the Work with Airport operations, the FMAA requires the Contractor to comply the Airport operational mandatory guidelines, operational restrictions, constraints in planning, and implemented the Work and associated stages. For Work schedule, refer to section 01 32 16.

.2 If the Work shall be required to be performed in phases or stages, the Contractor shall coordinate the Work with the FMAA through the Airport Construction Coordinator.

.3 The Contractor shall ensure that phasing of the Work shall accommodate all operational use of the Airport and the particular affected facility. Interruption or isolation of any operational areas of the Airport shall be permitted only by written permission of the Airport Construction Coordinator.

.4 Further details pertaining to construction Work phasing are set out in Section 01 11 00 – Summary of Work.

1.7 SCHEDULES CLOSURES

.1 The FMAA and Airport operations require prior approval for schedules closures of the existing facilities, if required for the Work, and such approval will be limited to restricted periods within which Work can be conducted and completed in order for Airport operations to be resumed on time and without interruption or delay.

.2 Scheduled closures of the existing facilities are set out by Airport operations and the FMAA and are defined on drawings or as directed. Refer to section 01 32 16.

1.8 OPERATION RESTRICTIONS AND CONSTRAINTS

.1 The Contractor shall comply with operational, obstruction zoning, safety, security, including Non-Passenger Screening (NPS) and Non-Passenger Vehicle Screening (NPSv) and other requirements in execution of the Work and when working in close proximity to live runways, taxiways, and aprons as specified in section 01 35 27, unless otherwise directed.

.2 Existing runways and associated taxiways must be available for carrier operations except for the scheduled hours of restricted operation and closures. No equipment or personnel movement across the runway and taxiway shall be permitted outside the times of the scheduled closures, except where flagging is scheduled by “listen and watch” procedures.

.3 Cancellation of closures: In the event of an aircraft emergency or operational requirement, low-visibility (CAT III) conditions, cross-wind conditions, other unforeseen or operational circumstances, or any other situation, as determined solely by the FMAA, the Contractor shall abide by the Airport Operations requirements, including:

.1 Stopping any Work on Airside to permit air traffic, emergency services, or other airport operations to use existing facilities;

.2 Evacuation or personnel and equipment to secure locations as directed;

.3 Sweeping and cleaning the airfield surfaces free from Foreign Object Damage (FOD) debris to the extent required and as directed and suitable for Airport operations;

.4 Removal of any obstructions, including stockpiled materials and equipment on site, and making the area safe for operation;

.5 Resumption of work on the site of Work within the evacuated areas will be as directed by the FMAA;

.6 No additional payment will be made for complying with this requirement;

.7 The actual time lost will be considered as a time extension to the Contract Substantial Performance date of the whole of the Work. Other damages, monetary or otherwise, will not be considered to the extent caused by such a delay.

.4 During the Air Show on Labour Day weekend, runways shall be kept operational and the Contractor shall schedule the Work and related construction activities to ensure that no Work is carried out within the Airport safety areas, as directed.

1.9 MOVEMENT OF EQUIPMENT AND MATERIALS

.1 The Contractor acknowledges that the movement of construction-related equipment, Materials and products in and out of Airport terminals or other designated buildings at the Airport is controlled by the FMAA Logistics Service Provider under the Logistics Program.

.2 The equipment used for execution of work in close proximity to runways and taxiways shall comply with the maximum height allowed at the specific airside area. The limiting height of all equipment used for execution of work is 45m.

1.10 HOURS OF WORK

.1 **General:** The Contractor acknowledges that hours of work shall depend on a number of factors, such as type of Work, location, and impact on Airport operations or major systems. In general, the following shall apply:

.1 For the purpose of execution the Work as set out in Section 01 11 00 – Summary of Work there is no restriction for hours or work.

.2 The FMAA reserves the right to change the restrictions on hours of work.

1.11 NO SMOKING POLICY

.1 The Contractor **acknowledges** that the FMAA has instituted a policy of NO SMOKING at the Airport, except in designated areas. This policy applies equally to all staff and Contractor's employees. The Contractor shall bring this policy to the attention of all their employees and shall rigidly enforce this policy.

1.12 MEASUREMENT PROCEDURES

.1 Payment and the cost **thereof** will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 GENERAL

.1 Prices included in the Contract shall be complete for the applicable work, and shall constitute the full consideration, payment, compensation and remuneration to the Contractor for all such work. For greater certainty, but without limitation to the foregoing, such prices shall constitute full and complete consideration, payment, compensation and remuneration to the Contractor for the following (subject to adjustment only as specified in the Contract Documents):

.1 Expenditures for wages and for salaries of workmen, engineers, superintendents, draftsmen, foremen, timekeepers, accountants, expediters, clerks, watchmen and such other personnel as may be approved, employed directly under the Contractor and while engaged on the applicable work at the site and expenditures for travelling and board allowances of such employees when required by location of the applicable work or when covered by trade agreements and when approved; provided, however, that nothing shall be included for wages or salary of the Contractor if an individual, or of any member of the Contractor's firm if the Contractor is a firm or the salary of any officer of the Corporation if the Contractor is a corporation, unless otherwise agreed to in writing;

.2 Expenditures for material used in or required in connection with the construction of the applicable work including material tests and mix designed required by the laws or ordinances of any authority having jurisdiction and not included under Subparagraph .9.

.3 Expenditures for preparation, inspection, delivery, installation and removal of materials, plant, tools and supplies;

.4 Temporary facilities as required for the applicable work;

.5 Travelling expenses properly incurred by the Contractor in connection with the inspection and supervision of the applicable work or in connection with the inspection of materials prepared or in course of preparation for the applicable work and in expediting their delivery;

.6 Rentals of all equipment whether rented from the Contractor or others, in accordance with approved rental agreements including any approved applicable insurance premiums thereon and expenditures for transportation to and from the site of such equipment, costs of loading and unloading, cost of installation, dismantling and removal thereof and repairs or replacements during its use on the applicable work, exclusive of any repairs which may be necessary because of defects in the equipment when brought to the work or appearing within thirty (30) days thereafter;

.7 The cost of all expendable materials, supplies, light, power, heat, water and tools (other than tools customarily provided by tradesmen) less the salvage value thereof at the completion of the applicable work;

.8 Assessments under the Workplace Safety Insurance Act, the Unemployment Insurance Act, Canada Pension Act, statutes pay or any similar statutes; or payments on account usual vacations made by the contractor to his employees engaged on the applicable work at the site to the extent to which such assessments or payments for vacations with pay relate to the work covered by the specified price; and all sales taxes or other taxes where applicable;

.9 The amounts of all Subcontracts related to the specified price;

.10 Premiums on all insurance policies and bonds called for under this Contract as related to the specified price;

.11 Royalties for the use of any patented invention on the applicable work;

.12 Fees for licences and permits in connection with the applicable work;

.13 Duties and taxes imposed on the applicable work; and

.14 Such other expenditures in connection with the applicable work as may be approved; provided always that except with the consent of FMAA, the above items of cost shall be at rates comparable with those prevailing in the locality of the work.

1.2 SUBMITTALS

.1 Submit the Schedule of Prices, in a spreadsheet format compatible with latest version of Excel.

.2 Provide a detailed breakdown of prices. Price each Section of the Specifications. This is to permit interim payments during the progress of the Works, include the following items:

.1 Quantities of major items of Work.

.2 Supporting invoices.

.3 Major equipment.

.4 Location by facility or area.

.3 Provide a Schedule of Estimated Progress Payments, in accordance with the following requirements:

.1 Submit with the initially acceptable Schedule of Prices.

.2 Submit adjustments thereto with the Application for Payment.

.3 Application for Payment.

.4 Final Application for Payment.

1.3 LUMP SUM PRICES

.1 Reflect the schedule of Sections and Prices and specified cash allowances in the Form of Tender, as applicable.

.2 Break down by Divisions number including a breakdown by each Specification Section number.

.3 Any schedule which is deemed by the Contract Administrator to be unbalanced or front-end loaded will not be acceptable.

.4 Summation of the complete Schedule of Prices representing all of the Work shall equal the Contract Price.

1.4 ITEMIZED PRICES

.1 Reflect the schedule of Sections and Prices and specified cash allowances in the Form of Tender, as applicable.

.2 An Itemized Price is the Bidder’s price for a specific item of Work included in the Contract Price and is provided for information purposes only.

.3 Itemized Prices include all labour, materials, products, equipment, services, respective overhead and profit, taxes, disbursements and related charges required to provide these items and represents the total amounts which are included in the Contract Price and as such represent the actual cost to FMAA.

.4 In the event of any discrepancy between an Itemized Price expressed in words and that price expressed in figures, the Itemized Price in figures shall prevail.

1.5 SEPARATE PRICES

.1 Reflect the schedule of Sections and Prices and specified cash allowances in the Form of Tender, as applicable.

.2 A Separate Price is the Bidder’s price for an additional item or section of the work to be added to the Base Bid and is not included in the Base Bid price.

.3 Separate Prices include all labour, materials, products, equipment, services, respective overhead and profit, taxes, disbursements and related charges required to provide these items and represents the total amounts which will be added to the Contract Price if these items are required to be included in the Contract, with no change to Contract Time unless stated otherwise with the respective Separate Price.

.4 In the event of any discrepancy between a Separate Price expressed in words and that price expressed in figures, the Separate Price in figures shall prevail.

.5 The following item is to be included and listed separately in the Procurement Form:

.1 Unit Price per Cubic Meter Measured on the Compacted Materials on the following items includes the labour, materials, and equipment to complete the Work:

.1 Replacement of soft/saturated material in the proposed pavement area with Granular B fill. This includes the over-excavation to achieve solid ground, supply and place additional Granular B material compacted to 100% SPMDD, and make ready for pavement, as specified in Division 31 and 32 Sections.

.2 Restoration of surface features including pavement to accommodate the above-noted over-excavation.

.3 Excavate and dispose of soil material that is not competent native soil under the lean concrete supporting the tank foundation shown in the design drawings. Fill the over-excavated area with lean concrete.

1.6 ALTERNATE PRICES

.1 Reflect the schedule of Sections and Prices and specified cash allowances in the Form of Tender, as applicable.

.2 An Alternative Price is an amount submitted for alternatives solicited by the FMAA which may be additions, deletions or no change to the Contract Price.

.3 Alternative Prices include all labour, materials, products, equipment, services, respective overhead and profit, taxes, disbursements and related charges required to provide these items, takes into consideration and allows for changes and adjustments in the other portions of the Work, and represents the total amounts which will be added to the Bid Price and Contract Price if these items are required to be included in the Contract, with no change to Contract Time unless stated otherwise with the respective Alternative Price.

.4 In the event of any discrepancy between an Alternative Price expressed in words and that price expressed in figures, the Alternative Price in figures shall prevail.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SUBSTITUTIONS

.1 Base the work of this Contract and the Contract Price using new materials and products specified.

.2 Where materials and products are specified only by reference to standards, provide any materials or products which meet the standard.

.3 Where materials or products are specified by trade name and a referenced standard, the material or product selected shall also meet the standard.

.4 Where materials and products are specified by naming one product, substitutions will not be considered unless the FMAA Project Manager has accepted an alternative prior to Contract signing.

.5 Where materials or products are specified by naming more than one material or product, provide any one of the specified materials or products.

.6 Where Specifications do not include "or other acceptable equivalents" or similar clause, provide specified product without substitution.

.7 Where the Specifications include "or other acceptable equivalents" or similar clause, substitutions proposed will be considered only under the following conditions:

.1 If the materials and products specified are not available; or

.2 If substitute materials and products to those specified, which are considered by the Consultant as equivalent or superior to those specified in performance and meeting the design intent, will not increase the Contract Price and Contract Time; or

.3 If a material or product is specified together with a requirement for performance and, in the opinion of the Contractor, the specified material or product will not produce the required results.

.8 With request for substitution include:

.1 Complete data substantiating compliance of the proposed substitute with contract requirements.

.2 For Products: Product identification, including manufacturer's name and address; manufacturer's literature, including product description, performance and test data, reference standards, and limitation, samples, if appearance is relevant; names and addresses of similar projects where the product has been used.

.3 For Construction Methods: Detailed description of the proposed method, and drawings illustrating it.

.4 Itemized comparison of proposed substitution with product or method specified.

.5 Data relating to changes in construction schedule.

.6 Quotation for change in contract sum if substitution is approved.

.9 In submitting a request for substitution, the Contractor represents:

.1 That the Contract has investigated the proposal and (unless the proposal explicitly states otherwise) determined that it is equal or superior to the product or method specified;

.2 That the same warranty will be furnished for the substitute as for the original;

.3 That the Contractor will co-ordinate installation of the accepted substitute into the work, making such changes in the Work as may be required to accommodate the change;

.4 That the Contractor will bear and waives all claims for additional compensation for costs which subsequently become apparent arising out of the substitution; and

.5 That the quotation is complete and includes all related costs.

.10 Substitutions will not be considered which are implicit in submitted shop drawings or samples rather than formally presented proposals as described above.

.11 Substitutions will not be considered which require substantial changes to the Contract Documents.

.12 Requests for substitutions prior to date set for receipt of bids will not be accepted.

.13 There is no obligation on the part of the Consultant or FMAA Project Manager to accept proposed substitutions.

1.2 SUBSTITUTIONS - CODE REQUIREMENTS

.1 Ensure that proposed substitutions for materials, products, methods and processes meet the requirements of the building code, and authorities having jurisdiction.

.2 Ensure that proposed substitute materials, products, methods and processes do not negate the compliance of adjacent materials, products and constructions with the requirements of the applicable building code and other requirements of authorities having jurisdiction, to which the proposed substitutions may be applied or attached.

.3 Obtain written approval of proposed substitutions from the authority having jurisdiction and submit the approval with the proposed substitution for the Consultant's consideration.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 APPLICATIONS FOR PAYMENT

.1 Applications for payment on account may be made monthly as the Work progresses, and shall be preceded by the submission of a Schedule of Values for review by the Consultant and the FMAA Project Manager.

.2 The second and all subsequent applications for payment shall include a statement based on the Schedule of Values, a FMAA statutory declaration, and a standard Workers Compensation Certificate of Clearance.

1.2 SCHEDULE OF VALUES

.1 The Contractor shall submit a Schedule of Values in spreadsheet form acceptable to the FMAA Project Manager.

.2 Identify on each Schedule of Values, the following information:

.1 Date of Issue

.2 Project name

.3 FAP number

.4 Contractor's name

.5 Payment period

.6 Payment certificate number

.3 Items of work listed shall include, but not be limited to, separate line items for the following:

.1 General Accounts

.2 Mobilization & Demobilization

.3 Supervision

.4 Bonds and Insurance

.5 Permits and Licenses

.6 All trades or portions of the Work, generally in chronological order

.7 Provision of other Products and/or services

.8 Cash Allowance expenditures

.9 Changes in the Work

.4 The total Contract amount for each trade or portion of the Work shall be listed beside each item.

.5 The Values of the Work shall be listed as to the aggregate percentage and dollar value completed, under the following major headings:

.1 Initial Contract Amounts for each line item,

.2 Progress to Date,

.3 Percent Complete,

.4 Current Invoice,

.5 Previous Billings,

.6 Contract Balance

.6 Work shall be subtotalled under original Contract, Cash Allowance expenditures, and Changes to the Work.

.7 Final totals shall identify:

.1 Total (gross) amount applied for

.2 Holdback deducted

.3 Holdback released (if any)

.4 Amount invoiced to date

.5 Net amount

.6 GST

.7 Amount due this Certificate

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 DESCRIPTION

.1 Coordination of the work of all Sections of the Specification is the responsibility of the Contractor.

.2 The Contractor will be deemed to possess the necessary technical skills to carefully evaluate all requirements of the Contract, and to have included in the Price all costs for the proper implementation of these requirements.

.3 The Contractor's responsibility includes, but is not restricted to, co-ordination specified in this Section, except where otherwise specified.

1.2 PROJECT MANAGEMENT

.1 The planning, scheduling, management and execution of the Work under the Contract shall be the responsibility of the Contractor.

.2 The Contractor shall set and accommodate realistic timeframes for each portion of the Work that shall permit the Contractor to meet the date set for Substantial Performance of the Work and Total Performance of the Work.

.3 Should the Work require the approval of FMAA airport operations for crane or equipment operation, or other FMAA Departments for services shut down, the Contractor shall make timely requests as called for and shall reflect the necessary approvals times in its schedules.

.4 Near the end of the Work, the Contractor shall allow suitable time for close-out procedures for testing, demonstration and training before the FMAA is required to issue a certificate of acceptance (occupancy permit).

1.3 PROJECT COORDINATION

.1 The Contractor shall be responsible for the overall coordination of the Work. The Contractor shall coordinate the work of all Subcontractors and provide such assistance as is necessary, including:

.1 Providing site dimensions and layout,

.2 Providing temporary facilities and controls,

.3 Scheduling Subcontractors' work so as to prevent conflicts,

.4 Scheduling and administering regular Subcontractor scheduling and coordination meetings throughout the progress of the Work, and

.5 Scheduling and administering regular Subcontractor safety meetings throughout the progress of the Work.

.2 The Contractor shall produce interference drawings where necessary for coordination of the Work. The Contractor shall provide such interference drawings to the FMAA for review.

1.4 WORK SUPERVISION

.1 The Contractor shall provide and maintain daily full-time supervision on the Work site and shall be available to the FMAA at all times.

.2 The Contractor's supervisor shall be responsible for the overall day-to-day coordination on site between Subcontractors. The supervisor shall coordinate the work of all Subcontractors and provide such assistance as is necessary.

1.5 PROJECT SITE ADMINISTRATION

.1 Maintain at the Work site one copy each of the following:

.1 Facility Alteration Permit

.2 Contract.

.3 Addenda.

.4 Reviewed shop drawings, product data and samples.

.5 Change Orders and other Contract modifications.

.6 Field test and inspection reports.

.7 Approved schedules.

.8 Manufacturer's installation and application instructions.

Updated as-built drawings.

.2 Store documents and samples in its field office apart from documents used for construction and provide files, racks, and secure storage for such storage.

.3 Label documents and file in accordance with section number listings in the Table of Contents of this Project Manual, including the labelling of each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain documents in clean, dry and legible condition and not use record documents for construction Work purposes.

.5 Keep documents and samples available for inspection by the Engineer.

1.6 RELATED MECHANICAL AND ELECTRICAL WORK

.1 Coordination of the installation of systems specified in Divisions 20 to 28 sections, including the interrelating operation and functioning between components of a system and between systems, is the responsibility of those performing the work of Divisions 20 to 28 sections, with final coordination the responsibility of the Contractor.

.2 Provide interference drawings as herein specified to ensure proper co-ordination of subtrade work. No extras will be considered for work not properly coordinated prior to installation.

.3 Ensure that service poles, pipes, conduit, wires, fill-pipes, vents, regulators, meters and similar Project service work is located in inconspicuous locations. If not indicated on Drawings, verify location of service work with Consultant before commencing installation.

1.7 QUALITY ASSURANCE

.1 Requirements of Regulatory Agencies:

.1 Coordinate requirements of authorities having jurisdiction.

.2 Quality Control:

.1 Ensure that work meets specified requirements.

.2 Schedule, supervise, and coordinate inspection and testing as specified in Section 01 40 00 – Quality Requirements.

.3 Job Records:

.1 Maintain job records and ensure that such records are maintained by Subcontractors.

1.8 SUPERINTENDENCE

.1 Provide superintendent and necessary supporting staff personnel who shall be in attendance at the Place of the Work while Work is being performed, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

.2 The Contractor shall appoint a superintendent at the Place of the Work who shall have overall authority at the Place of the Work and shall speak for the Contractor and represent the Contractor’s interest and responsibilities at meetings at the Place of the Work and in dealings with the Consultant and the FMAA Project Manager.

.3 Supervise, direct, manage and control the work of all forces carrying out the Work, including subcontractors and suppliers. Carry out daily inspections to ensure compliance with the Contract Documents and the maintenance of quality standards. Ensure that the supervisory staff includes personnel competent in supervising all Sections of Work required.

.4 Arrange for sufficient number of qualified assistants to the supervisor as required for the proper and efficient execution of the Work.

1.9 SUBMITTALS

.1 Provide a complete set of all required Contract Documents, together with instructions for changes to the work which are issued, to each firm preparing shop drawings.

.2 Schedule and expedite submission of specified submittals.

.3 Review submittals and make comments as specified in Section 01 33 00 – Submittal Procedures.

.4 Ensure that each original submission, and their subsequent revisions and resubmissions are made on schedule.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 It is the responsibility of the Contractor to ensure that the supplier or distributor of materials specified or accepted alternatives, which have been bid, has materials on the site when required. The Contractor shall obtain confirmed delivery dates from the supplier, and ensure no delay in the progress of the work

.2 Provide equipment delivery schedule, coordinated with construction and submittals schedule, showing delivery dates for major and/or critical equipment. Provide delivery access and unloading areas.

.3 Make available areas for storage of products and construction equipment to meet specified requirements, and to ensure a minimum of interference with progress of the work and relocation.

.4 Make access available for transference of stored products and construction equipment to work areas.

.5 The Contractor shall contact the Consultant immediately upon receipt of information indicating that any material or item, will not be available on time, in accordance with the original schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.

.6 The Consultant reserves the right to receive from the Contractor at any time, upon request, copies of actual purchase or work orders of any material or products to be supplied for the work.

.7 If materials and products have not been placed on order, the Consultant may instruct such items to be placed on order, if direct communication in writing from the manufacturer or prime suppliers is not available indicating that delivery of said material will be made in sufficient time for the orderly completion of the Work.

.8 The Consultant's review of purchase orders or other related documentation shall in no way release the Contractor, or his subcontractors and suppliers from their responsibility for ensuring the timely ordering of all materials and items required, including the necessary expediting, to complete the work as scheduled in accordance with the Contract Documents.

.9 Deliver product vehicle shall in coordination with vehicular traffic as specified in accordance with Section 01 35 56 – Traffic Control Procedures and as required in the latest version of 2023 Airport Construction Code v8.0.

.10 Store product to designated area as directed by the FMAA Project Manager.

1.11 COORDINATION MEETINS

.1 Refer to Section 01 31 19.

1.12 JOB CONDITIONS

.1 Ensure that conditions within the building are maintained and that work proceeds under conditions meeting specified environmental requirements.

.2 Ensure that protection of adjacent property and the work is adequately provided and maintained to meet specified requirements.

1.13 WARRANTIES

.1 Ensure that warranties are provided, as indicated in Section 01 78 36 – Warranties.

.2 Coordinate warranty conditions of interconnected work to ensure that full coverage is obtained.

1.14 CO-ORDINATION

.1 Review Contract Documents and advise the Consultant of possible conflicts between parts of the work before preparation of shop drawings, ordering of products or commencement of affected work.

.2 Coordinate and be responsible for layout of all work in each area and work on which subsequent work depends to facilitate mutual progress, and to prevent conflict between parts of the work.

.3 No addition to the Total Price will be allowed because of interference between the parts of the work of a trade or between the work of different trades unless such interference was brought to the attention of the consultant in writing prior to the start of construction.

.4 Ensure that each Section makes known, for the information of the Contractor and other Sections, the environmental and surface conditions required for the execution of its work; and that each Section makes known the sequences of others' work required for installation of its work.

.5 Ensure that each Section, before commencing work, knows requirements for subsequent work and that each Section is assisted in the execution of its preparatory work by Sections whose work depends upon it.

.6 Ensure that work to be enclosed within ceiling and/or wall spaces can be so accommodates without interference and with other parts of the work.

.7 Ensure that setting drawings, templates, and all other information necessary for the location and installation of materials, holes, sleeves, inserts, anchors, accessories, fastenings, connections, and access panels are provided by each Section whose work requires cooperative location and installation by other Sections, and that such information is communicated to the applicable installer.

.8 Deliver materials supplied by one Section to be installed by another well before the installation begins, as per Construction Progress Schedule.

.9 Sections giving installation information in error, or too late to incorporate in the work, shall be responsible for having additional work done which is thereby made necessary.

.10 Remove and replace work installed in error which is unsatisfactory for subsequent work.

.11 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.

.12 Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.

.13 Ensure that clearance required by authorities having jurisdiction and for proper maintenance are indicated on Drawings.

.14 Distribute coordination drawings well in advance of fabrication and installation of work affected. Place no orders for affected equipment without submission of coordination drawings to the supplier.

.15 Coordinate your activities to minimize interference with the work of Other Contractors and FMAA Workers working or will be working at the Work area as per Section 01 11 00 Summary of Work.

1.15 COOPERATION

.1 Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the Work and set in place or instruct separate Subcontractors as to their location.

.2 Supply items to be built in, as and when required together with templates, measurements, shop drawings and other related information and assistance.

.3 Pay the cost of extra work and make up time lost as a result of failure to provide necessary information and items to be built in.

1.16 PROJECT RECORD DRAWINGS

.1 Record, as the work progresses, work constructed differently than shown on Contract Documents. Record all changes in the work caused by site conditions; by FMAA Project Manager, Consultant, sub-consultants, Contractor, and Subcontractor originated changes; and by site instructions, supplementary instructions, field orders, change orders, addendums, correspondence, and directions of authorities having jurisdiction. Accurately record location of concealed structure, and mechanical and electrical services, piping, valves, conduits, pull boxes, junction boxes and similar work not clearly in view, the position of which is required for maintenance, alteration work, and future additions. Do not conceal critical work until its location has been recorded.

.2 Dimension location of concealed work in reference to building walls, and elevation in reference to floor elevation. Indicate at which point dimension is taken to concealed work. Dimension all terminations and offsets of runs of concealed work.

.3 Make records in a neat and legibly printed manner with a non-smudging medium.

.4 Identify each record drawing as "Project Record Copy". Maintain drawings in good condition and do not use them for construction purposes.

.5 After completion of the work, purchase a complete set of white prints from the Consultant and transfer the information recorded on the white prints accurately, neatly in red ink with dimensions, as applicable. Return these marked-up as-built white prints plus two additional sets of white prints to the Consultant for his review. Any subsequent changes found by the Consultant shall remain the responsibility of the contractor and new white prints will be issued for these changes and re-submitted back to the Consultant at no charge to the FMAA.

.6 Maintain Project record drawings in a state current to Project. Such state will be considered a condition precedent for validation of applications for payment. The Consultant's visual inspection will constitute proof that record drawings are current.

.7 Provide Consultant with accurate, red-marked record drawings for their transfer to latest version of AutoCAD or other applicable BIM software with application for Certificate of Substantial Performance. Final acceptance of the Work will be predicated on receipt and approval of record drawings.

1.17 CUTTING AND PATCHING

.1 Before cutting, drilling, or sleeving structural load-bearing elements, obtain approval of location and methods from the Consultant.

.2 Do not endanger work or property by cutting, digging, or similar activities. No Section shall cut or alter the work of another Section unless such cutting or alteration is approved by the latter Section and the General Contractor.

.3 Cut and drill with true smooth edges and to minimum suitable tolerances.

.4 Fit construction tightly to ducts, pipes and conduits to stop air movement completely. The Section performing work that penetrates a fire, air, vapour, moisture, thermal or acoustic separation of the

building shall pack voids tightly with rock wool, fibreglass or fire stop material as may be required; seal air, vapour and moisture barriers; and caulk joints as may be required to ensure that no air movement through the penetration is possible.

.5 Cutting, drilling and sleeving of work shall be done only by the Section who has installed it. The Section requiring drilling and sleeving shall inform the Section performing the work of the location and other requirements for drilling and sleeving.

.6 Replace, and otherwise make good, all damaged work, as identified by the Consultant or Contractor.

.7 Cutting and Patching for Holes Required by Mechanical and Electrical work:

.1 Include under work of Divisions 20 to 28 sections, cutting or provision of holes up to and including 325 cm^2 and related patching, except as otherwise indicated.

.2 Include under work of this Division holes and other openings larger than 325 cm^2, and chases, bulkheads, furring and required patching. This Section shall be responsible for determination of work required for holes in excess of 325 cm^2.

.8 This Section shall be responsible for all cutting and patching in addition to that specified for mechanical and electrical work, and shall directly supervise performance of cutting and patching by other Sections.

.9 Patching or replacement of damaged work shall be done by the Subcontractor under whose work it was originally executed, and at the expense of the Subcontractor who caused the damage.

.10 Make patches as invisible as possible in final assembly to the approval of the Consultant and FMAA Project Manager. Unacceptable work will be replaced at no charge to FMAA.

1.18 ADDITIONAL DOCUMENTS

.1 The FMAA may in its discretion issue additional documents in the form of drawings, specifications, schedules, or written instructions in order to assist proper execution of the Work by the Contractor. These documents shall take one of the following forms:

.1 Supplemental (Site) Instruction: to be used where there shall be no anticipated adjustment in the Contract Price or Contract schedule.

.2 Contemplated Change Notice (CCN): a notice issued by the FMAA describing additions, deletions, or changes to the Work proposed by the FMAA to be performed by the Contractor pursuant to a proposed Change Order

.3 Change Order: amendment to the Contract agreed upon by the FMAA and the Contractor.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer meetings every 2 weeks (or more frequently as required) with the Consultant throughout the progress of the Work. Schedules to be updated with the Consultant every 2 weeks for distribution at each meeting.

.2 Prepare agenda for such meetings.

.3 The Contractor shall chair such meetings. The Contractor shall administer such meetings and prepare minutes within three (3) days after the meeting date for distribution to the FMAA Project Manager and the Consultant.

.4 Distribute written notice of each meeting four (4) days in advance of meeting date to the Consultant and the FMAA Project Manager and other affected parties.

.5 Representatives of parties attending meetings shall be authorized to act on behalf of the parties they represent. Subcontractors and Suppliers do not attend meetings unless authorized by the Consultant and the FMAA Project Manager.

.6 Prepare and distribute monthly progress reports in accordance with Section 01 32 16 – Construction Progress Schedule, and containing updated schedules, construction photos in accordance with Section 01 33 00 – Submittal Procedures, shop drawing logs, requests for interpretation logs, submittals and budget.

1.2 CONTRACT START-UP MEETING

.1 Within five (5) days after award of Contract, request a meeting of parties in Contract to discuss and resolve administrative procedures and responsibilities prior to the commencement of the Work.

.2 The FMAA Project Manager, the Consultant, the Contractor, site superintendent(s), inspection and testing company, and authorities having jurisdiction, as applicable and at their discretion, will be in attendance.

.3 Agenda to include the following:

.1 Appointment of official representative of participants in the Project.

.2 Status of permits, fees and requirement of authorities having jurisdiction. Action required.

.3 Review of standard project forms.

.4 Requirements for Contract modification and interpretation procedures, including, but not limited to: requests for interpretation, proposed Change Orders, Change Orders, Change Directives, Supplemental Instructions, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.5 Requirements for notification for reviews. Allow a minimum of two (2) Working Days notice to Consultant for review of the Work.

.6 Review of schedules and scheduling procedures and requirements in accordance with Section 01 31 13 – Project Coordination.

.7 Review of work restrictions requirements. Refer to Section 01 14 00 – Work Restrictions.

.8 Appointment of inspection and testing agencies or firms, Section 01 40 00 – Quality Requirements.

.9 Requirements for temporary facilities, signs, offices, storage sheds, utilities; Section 01 50 00 – Temporary Facilities and Controls.

.10 Security requirements at and for the Place of the Work, Section 01 50 00 – Temporary Facilities and Controls.

.11 Record drawings, Section 01 33 00 – Submittal Procedures.

.12 Maintenance manuals, Section 01 33 00 – Submittal Procedures.

.13 Take-over procedures, acceptance, Section 01 77 19 – Closeout Requirements.

.14 Warranties, Section 01 78 36 – Warranties.

.15 Progress claims, administrative procedures, holdbacks.

.16 Insurances, transcripts of policies.

.17 Contractor's safety procedures.

.18 Cleaning/staging area for vehicles.

.19 Workplace Safety and Insurance Board Certificate.

.4 The FMAA Project Manager and Consultant shall organize and chair the contract start-up meeting. Contractor will provide meeting agenda to FMAA Project Manager and Consultant five (5) days prior to meeting for review. Contractor shall record minutes of the contract start-up meeting and distribute a copy to FMAA Project Manager, Consultant and each participant within ten (10) days of meeting.

1.3 PRE-CONSTRUCTION MEETINGS

.1 The Engineer or his delegate shall arrange and chair the pre-construction meeting for the Work. The following items (as a minimum) shall be discussed (not necessarily in order):

.1 Introduction of participants and stakeholders,

.2 Review of the scope of the Work,

.3 Construction safety requirements,

.4 Security requirements,

.5 Operational requirements,

.6 Delivery of Materials,

.7 Communication and requests protocols,

.8 Schedules,

.9 Invoicing and payments,

.10 Frequency of regular progress meetings as agreed by the FMAA and the Contractor,

.11 Other items as determined by the participants.

1.4 PRE-INSTALLATION MEETINGS

.1 During the course of the Work prior to Substantial Performance of the Work, schedule pre-installation meetings as required by the Contract Documents and coordinated with the Consultant.

.2 The Contractor shall schedule and administer pre-installation meetings as specified in individual sections of the Plans and Specifications or as requested by the FMAA. As a minimum the following Persons shall attend:

.1 Contractor (Project Manager and Site Superintendent),

.2 Installation Subcontractor (Project Manager and Site Foreperson),

.3 Major Subcontractor (if scope of the installation subcontractor is under the Contract),

.4 Product or system supplier (technical representative),

.5 FMAA consultant if applicable (sub consultants as required),

.6 FMAA representative

.3 As far as possible, pre-installation meetings shall be scheduled to take place on the same day as regularly scheduled progress meetings.

.4 Agenda to include the following:

.1 Appointment of official representatives of participants in the Project.

.2 Review of existing conditions and affected work, and testing thereof as required.

.3 Review of installation procedures and requirements.

.4 Review of environmental and site condition requirements.

.5 Review of schedules and scheduling procedures and requirements of the applicable portions of the Work in accordance with Section 01 32 16 – Construction Progress Schedule, in particular:

.1 Schedule of submission of samples, mock-ups, and items for Consultant's consideration.

.2 Delivery schedule of specified equipment.

.3 Requirements for notification for reviews. Allow a minimum of two (2) Working Days notice to Consultant for review of the Work.

.6 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences, Section 01 50 00 – Temporary Facilities and Controls.

.7 Requirements for inspections and tests, as applicable.

.1 Schedule and undertake inspections and tests in accordance with Section 01 32 16 – Construction Progress Schedule and Section 01 40 00 – Quality Requirements.

.8 Special safety requirements and procedures.

.5 The following shall be in attendance:

.1 Contractor.

.2 Subcontractors affected by the work for which the pre-installation meeting is being conducted.

.3 Consultant.

.4 Manufacturer's representatives, as applicable.

.5 Inspection and testing company, as applicable.

1.5 PROGRESS MEETINGS

.1 During the course of the Work prior to Substantial Performance of the Work, schedule progress meetings every two (2) weeks.

.2 In advance of progress meetings, Contractor shall submit to the Consultant a two week look ahead schedule of items of work to be undertaken in the two weeks subsequent to the progress meeting. distribute written notice of each meeting to the FMAA Engineer and its consultant not less than four (4) days in advance of the meeting date, accompanied by the proposed agenda for the upcoming meeting. Including a two week look ahead schedule will be reviewed at the meeting. Refer to Section 01 32 16 – Construction Progress Schedule for requirements for look ahead schedule.

.3 The Contractor shall provide physical space and facilities relative to project size and complexity and make all necessary arrangements for meetings.

.4 The Engineer or its delegate shall chair all Work site meetings.

.5 The Contractor shall record and distribute all minutes, which minutes shall itemize significant proceedings and decisions and identify 'action by' appropriate parties.

.6 The Contractor shall reproduce copies of the minutes within three (3) days after each meeting and transmit to the FMAA for review and approval. Upon approval, the Contractor shall distribute the minutes to all meeting participants and affected parties not in attendance.

.7 Attendees at progress meetings shall include the following:

.1 Contractor.

.2 Contractor's site superintendent(s).

.3 Consultant.

.4 FMAA Project Manager.

.8 Agenda to include the following:

.1 Review, approval of proceedings of previous meeting.

.2 Review of items arising from proceedings.

.3 Review of progress of the Work since previous meetings.

.4 Review of schedules in accordance with Section 01 32 16 – Construction Progress Schedule, including:

.1 Revisions to construction schedule.

.2 Progress and schedule for subsequent period of the Work: Two (2) week look-ahead.

.3 Problems that impede compliance with construction schedule.

.4 Review of off-site fabrication delivery schedules.

.5 Review of material delivery dates/schedule.

.6 Corrective measures and procedures to regain construction schedule.

.7 Review of submittal schedules: expedite as required.

.5 Field observations, problems, conflicts.

.6 Review status of submittals.

.7 Maintenance of quality standards.

.8 Pending changes and substitutions.

.9 Review of Contract modifications and interpretations including, but not limited to: requests for interpretation and log, proposed Change Orders, Change Orders, Change Directives, Supplemental Instructions, for effect on construction schedule and on Contract Time.

.10 Review of status of as-built documents.

.11 Other business.

1.6 PRE-TAKEOVER MEETING

.1 Prior to application for Substantial Performance of the Work, schedule a pre-takeover meeting.

.2 Agenda to include the following:

.1 Review, approval of proceedings of previous meeting.

.2 Review of items arising from proceedings.

.3 Review of procedures for Substantial Performance of the Work, completion of the Contract, and handover of the Work.

.4 Field observations, problems, conflicts.

.5 Review of outstanding Contract modifications and interpretations including, but not limited to: requests for interpretation and log, proposed Change Orders, Change Orders, Change Directives, Supplemental Instructions, for effect on construction schedule and on Contract Time.

.6 Problems which impede Substantial Performance of the Work.

.7 Review of procedures for deficiency review. Corrective measures required.

.8 Progress, schedule, during succeeding period of the Work.

.9 Review submittal requirements for warranties, manuals, and all demonstrations and documentation required for Substantial Performance of the Work.

.10 Review of status of as-built documents and record drawings.

.11 Other business.

1.7 POST-CONSTRUCTION MEETING

.1 Prior to application for completion of Contract, schedule a post-construction meeting. Four days prior to date for meeting, Consultant shall confirm a date for meeting based on evaluation of completion requirements.

.2 Agenda to include the following:

.1 Review, approval of proceedings of previous meeting.

.2 Confirmation that no business is arising from proceedings.

.3 Confirmation of completion of the Contract, and handover of reviewed documentation from the Consultant to the FMAA Project Manager.

.4 Confirmation of completion of proposed Change Orders, Change Orders, Change Directives, and Supplemental Instructions.

.5 Problems that impede Contract completion.

.6 Identify unresolved issues or potential warranty problems.

.7 Confirmation of completion of deficiencies.

.8 Corrective measures required.

.9 Confirm submittal requirements for warranties, manuals, and demonstrations and documentation for Contract completion are in order.

.10 Review of procedures for communication during post-construction period.

.11 Handover of reviewed record documents by the Consultant to the FMAA Project Manager.

.12 Handover of Contract completion insurance policy transcripts by Contractor.

.13 Submission of final application for payment.

.14 Review and finalize outstanding claims, pricing, and allowance amounts.

.15 Status of commissioning and training.

.16 Demobilization and the Place of the Work restoration.

.17 Review of requests for interpretation log.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 LAYOUT AND SURVEY

.1 Lines, Levels and Locations for Building:

.1 Existing grades, lines, and site conditions shown on drawings were taken from survey information established by persons engaged directly by FMAA Project Manager. The accuracy of survey information is not the Consultant's responsibility.

.2 The FMAA Project Manager will establish location of property lines. The Contractor shall establish necessary lines and levels, and provide batter boards and other means to control the accurate positioning of all building elements.

.2 Work Adjacent to Public Property:

.1 Verify before commencing work at adjacent public property, that no plans for altering clearances, set-backs, easements, grades, or otherwise have been made by local authorities having jurisdiction, subsequent to their approval of Contract Documents, and which would affect the original intent.

1.2 SUBMITTALS

.1 Submit qualification data for land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

.2 Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

.3 Submit two (2) copies of certified survey signed by registered land surveyor.

.4 Submit two (2) copies of final property survey showing the Work performed and record survey data.

.5 Submit a Certificate of Compliance at completion of site grading stating the “As Constructed” grading elevations, and whether or not they differ from design grades.

1.3 DRAINAGE

.1 Ensure that positive drainage is provided to roof, floor and site drains and catch basins, as set in their final positions. Provide constant slopes for drained surfaces to drains and drainage courses.

.2 Ensure that allowable construction tolerances and structural tolerances do not permit ponding of water.

.3 Verify the extent of each area served by a drain, or drainage course, to eliminate possible undrained surfaces. Coordinate the work of involved Sections before each proceeds.

1.4 RECORD DRAWINGS

.1 Prepare interference and equipment placing drawings to scale to ensure that all components will be properly accommodated within the spaces provided.

.2 Ensure that clearances required by authorities having jurisdiction and/or for easy maintenance of equipment will be shown on the above drawings.

.3 Interference drawings shall be prepared before any orders for equipment and/or materials are released to suppliers.

1.5 SURVEY REFERENCE POINTS AND LEGAL SURVEY MARKERS

.1 Verify existing base horizontal and vertical control points designated on drawings.

.2 Locate, confirm and protect control points and legal survey markers prior to starting site work; preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Consultant.

.4 Report to Consultant when a reference point or legal survey marker is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Replace control points in accordance with original survey control.

.6 Replace legal survey markers lost or destroyed as a result of construction activities.

1.6 SURVEY LAYOUT

.1 Coordinate with Contractor for layout and protection of grade controls.

.2 Establish permanent bench mark(s) as required, referred to established bench marks by survey control points; record locations, with horizontal and vertical data.

.3 Establish lines and levels, locate and layout, by instrumentation.

.4 Stake for grading, cuts and fills, slopes.

.5 Replace grade controls lost or destroyed as a result of construction activities.

1.7 CONSTRUCTION LAYOUT

.1 Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Consultant promptly if discrepancies are discovered.

.2 Engage a land surveyor to lay out the Work using accepted surveying practices:

.1 Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

.2 Establish dimensions within tolerances indicated; do not scale Drawings to obtain required dimensions.

.3 Inform installers of lines and levels to which they must comply.

.4 Check the location, level and plumb, of every major element as the Work progresses.

.5 Notify Consultant when deviations from required lines and levels exceed allowable tolerances.

.6 Verify accuracy of site dimensions shown on drawings.

.7 Verify that present, or known future restrictions, are not violated by construction on the site or lines of traverse to all public utilities.

.8 Verify accurately the final underground location on site of all buried storm, sanitary, water and electrical duct banks, when applicable.

.9 Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

.3 Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

.4 Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each

survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant when requested.

1.8 FIELD ENGINEERING

.1 Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations:

.1 Do not change or relocate existing benchmarks or control points without prior written approval of Consultant.

.2 Report lost or destroyed permanent benchmarks or control points promptly.

.3 Report the need to relocate permanent benchmarks or control points to Consultant before proceeding.

.4 Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

.5 Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

.6 Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

.7 Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

.2 Provide as-built site survey information after completion of demolition and excavation operations ready for construction.

.1 Survey grade elevations shall be on a 9 m grid or as required to locate property lines and new building structural grid lines.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 WORK SCHEDULE

.1 The planning, scheduling, management, and execution of the Work in accordance with the Contract Documents shall be the responsibility of the Contractor. The FMAA will operate a system of overall project control. The Contractor is required to provide all information and assistance necessary to integrate Work of this Contract into the overall system.

.2 Interim reviews of work progress based on Work schedule shall be conducted by the Contractor and the FMAA's representative at time and frequency as directed by the FMAA and schedule updates by the Contractor in conjunction with and to the approval of the FMAA.

.3 The Contractor shall allow adequate flexibility in schedule for recognition that construction Work may have to be interrupted from time to time, in certain areas, to permit airport operational requirements to be met. Refer to Section 01 14 00 - Work Restrictions.

.4 Scheduled Closures: Scheduled closures for the existing facilities are set out by Airport operations and FMAA and are defined on the plans and specifications or as directed.

.1 Requests for alternative construction work hours and closure with FMAA.

.2 Full Closures: Closure periods for facilities that are decommissioned and planned for extended closures until planned Work is completed are as shown on drawings, unless otherwise directed.

.5 Scheduled closures are required for the following:

.1 Work in areas within 150.0 meters and beyond from a runway centreline with the 7H:1V Transitional Surface height restriction or 47.5 meters of taxiway centerline or within 42.5 meters of taxilane or on aprons, and due to airport operational requirements.

.2 Work within the Airport restricted zoning and navigational aids sensitive areas.

.3 Work in areas as defined on drawings or as directed.

.6 The Work outside the Airport restricted zoning can be carried out during day or night subject to FMAA's approval.

.7 All crossing points to Work site shall be swept clean by the Contractor on a continuous basis. Construction haulage will be stopped if cleaning falls behind.

.8 Runways will be in operation during the Contract Period.

.9 Dependent on wind direction, aircraft will be arriving toward or departing away from the Work area.

.10 Contractor shall perform work without interruption to traffic on any airside or groundside roads and such roads are to be maintained free of loose or foreign materials and equipment to the satisfaction of the FMAA.

.11 The Contractor shall comply with specified requirements of Section 01 35 27 Special Procedures: Airport Facilities and as directed.

1.2 DETAILED CRITICAL PATH SCHEDULE

.1 An approved detailed critical path schedule must be in place twenty (20) business days after the award of the Contract or prior to start of the Work, whichever is earlier. Schedule to be in an approved format that can be loaded into MS Project or other approved software.

.2 The Contractor shall allow ten (10) business days for review and approval of the submitted critical path schedule.

.3 The detailed critical path schedule will be based on precedence format including the following:

.1 Bar chart Schedule

.2 Electronic schedule file in an approved format that can be loaded to MS Project software.

.3 Activity listing report

.4 The schedule submitted by the Contractor shall represent a practical plan to complete the Work within the time period required by the Contract Documents, the specified operational restrictions and restraints, the constraints and construction plan shown on drawings and shall comply with the specific dates stated therein for completion of each segment of the Work. Schedule shall show in sufficient detail the sequence in which the Work will be performed and the dates on which each portion will be completed.

.5 The Contractor shall allow in schedule sufficient allowance for inclement weather, for rainy days and for interruptions due to traffic emergencies and due to low visibility conditions, etc.

.6 The Contractor shall coordinate with FMAA in the preparation of the schedule to establish the number of activities required and the logic and sequence of events.

.7 The maximum duration for any activity shall be twenty (20) working days; the minimum shall be one (1) working day. Activities shall not encompass the Work of more than one construction operation, trade or Subcontractor.

.8 The Contractor shall include detailed activities for; Material/equipment procurement, including shop drawings preparation; submission and review; fabrication and delivery; equipment installation; Substantial Performance of the Work, Total Completion of the Work, demonstration and training, testing and commissioning. The Contractor shall provide for necessary construction logic, sequence and timing, showing all logic ties, interdependencies and constraints. The Contractor shall ensure the participation of all Subcontractors and suppliers.

.9 The schedule shall be the Contractor's intended working schedule and is to be used to plan, organize and execute the Work; record and report actual performance and progress; and assess any delay, where applicable.

.10 CPM software shall be used for preparation of schedule and reports.

.11 The Contractor shall employ qualified personnel trained in the preparation and utilization of the Critical Path Method of planning and scheduling. This individual shall be responsible for monitoring progress, updating and revising schedules and logic diagrams as specified or as directed.

.12 The Contractor shall provide with schedule, an estimated cost of construction for activities identified in schedule and the projected cash flow. The aggregate total of the cost of activities shall equal the total Contract Price.

.13 Updating Schedules:

.1 The Contractor shall review the schedule as follows:

.1 Interim review of Work progress based on the schedule will be conducted weekly by FMAA/Resident Services Consultant.

.2 Inspect whole of the Work with FMAA/Resident Services Consultant or FMAA Representative where no Resident Services Consultant has been engaged on a weekly basis to establish progress of each current activity shown in schedule. If any such activities are over-running estimated time, indicate what corrective action will be taken to bring them back on schedule.

.3 Provide look-ahead schedules for specific Work activities to be undertaken during the following week in conjunction with and to approval of the FMAA's Representative.

.4 Identify and submit supporting documentation as to any delays alleged to be beyond the Contractor's control for which an extension of time is to be sought in

accordance with the General Conditions of Contract. It is intended that the FMAA will review and evaluate any extensions owing under the terms of the Contract as the Work proceeds.

.5 Time extensions shall not be granted for delays in parts of the Work until float time available for all parts of the Work involved is used.

.2 The Contractor shall update the CPM schedule bi-monthly on the 15th and the last day of each month detailing activities started, completed, percentage completed, predicted completion dates, scope changes, other identifiable changes and such other information as the FMAA may request including:

.1 Bar chart schedule.

.2 Activity listing report sorted by area of work and showing activity number, description, durations, percentage complete, actual start and finish, early/late start and finish and total float.

.3 Written narrative report on schedule status and the corrective actions which have been or are being taken to maintain progress on schedule in the future, any anticipated delay(s), source availability, schedule deviations and Work anticipated to be achieved during the next period.

.3 A schedule that shows that Work being completed after the agreed upon completion date and/or interim milestones will not be accepted.

Should the Contractor fail to provide a satisfactory schedule and/or updates in a timely manner, the FMAA may suspend interim payment, prepare the schedules required, and deduct the cost from Contractor's progress payments.

1.3 ELECTRONIC PHOTOS

.1 The Contractor shall submit electronic and hard copy of colour digital photography in jpg format, standard resolution:

.1 Identification: Name and number of project and date of exposure indicated.

.2 Number of viewpoints: minimum six (6) locations of viewpoints determined by FMAA.

.3 Frequency: Monthly with progress statement.

1.4 SUBMITTALS SCHEDULE

.1 The Contractor shall:

.1 Include schedule for submitting shop drawings, product data, and samples

.2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule

.3 Include dates when reviewed submittals will be required from FMAA or their representative.

1.5 MEASUREMENT PROCEDURES

.1 No additional payment will be made under the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

NOT USED

END OF SECTION

1 General

1.1 PLANNING, SCHEDULING AND MONITORING - GENERAL

.1 This section includes requirements for the preparation, monitoring and revision of construction schedules.

.2 The purpose of the schedules and reports mandated in this section is to:

.1 Ensure adequate planning and execution of the Work by the Contractor;

.2 Establish the standard against which satisfactory completion of the project will be judged;

.3 Assist the FMAA Project Manager and the Consultant in monitoring progress;

.4 Assess the impact of changes to the Work.

.5 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.

.6 Ensure project schedule efficiencies through monitoring of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.

.7 Monitor sufficiently often so that causes of delays can immediately be identified and removed.

.8 Keep team aware of changes to schedule, and possible consequences as project progresses.

.9 Use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.

.10 Begin narrative reporting with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

.3 The Contractor has the obligation and responsibility at all times to plan and monitor all of its activities, anticipating and scheduling its staff, materials, plant and work methods in a manner that is likely to ensure completion of the Work in accordance with the terms and conditions of the Contract and at a rate that will allow the Work to be completed on time.

1.2 CPM SCHEDULING REQUIREMENTS

.1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.

.2 Revise Master Schedule and Detail Schedule deemed impractical by Consultant and resubmit for approval.

.3 Change to Contract Duration:

.1 Acceptance of Master Schedule and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract.

.2 Duration of Contract may only be changed through bilateral Agreement.

.4 Consider Master Schedule and Detail Schedule deemed practical by Consultant, showing Work completed in less than specified Contract duration, to have float.

.5 First Milestone on Master Schedule and Detail Schedule will identify start Milestone with an "ES" constraint date equal to Award of Contract date.

.6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.

.7 Substantial Completion with "LF" constraint equal to calculated date.

.8 Calculations on updates to be such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.

.9 Delays to non-critical activities, those with float may not be basis for time extension.

.10 Do not use float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times, or imposed dates other than required by Contract.

.11 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated.

.1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

.12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.

.1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

.13 Arrange participation on and off site of subcontractors and suppliers, as required by Consultant, for purpose of network planning, scheduling, updating and progress monitoring.

.1 Approvals by Consultant of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.

.14 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

.15 The schedules required by this section shall take the form of time-scaled diagrams prepared using a computerized scheduling system, capable of producing resource-and/or cost-loaded Critical Path Method (CPM) schedules.

.16 General requirements applicable to all schedules include the ability to:

.1 Easily summarize, group, sort and filter activities by area, phase or other categorization as applicable, or any combination thereof;

.2 Electronically compare any given schedule with any previous or subsequent update;

.3 Generate monthly progress claims and cash flow projections through resource and cost loading activities;

.4 Show schedules in bar chart, network diagram and time scaled logic diagram formats;

.5 Apply different calendars to applicable activities; and

.6 Transmit schedules electronically via e-mail attachments.

.17 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow coordination and control of project activities. Show continuous flow from left to right.

.18 Float is defined as the amount of time between the earliest start date and the latest start date of an activity or chain of activities on the CPM schedule. Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout Contract Time to form "Critical Path".

.19 Use of float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times, or imposed dates, other than as required by the Contract, shall be cause for the rejection of any schedule submitted by the Contractor.

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Schedules shall be submitted to the Consultant in both PDF format and original software data file format within ten (10) days of Contract Award for FMAA Project Manager and Consultant review.

.3 FMAA Project Manager and Consultant will review schedule and return review copy within ten (10) days after receipt.

.4 Resubmit finalized schedule within five (5) days after return of review copy.

.5 Electronic schedule submissions shall be in an original scheduling software data file type that permits modification of the layouts and data. In case of a discrepancy between an original software file and PDF schedule, the PDF of the schedule shall govern.

.6 Include costs for execution, preparation and reproduction of schedule submittals in tendered price.

.7 Submission of the schedules referred to in this Section shall constitute the Contractor's representation that:

.1 Contractor and its Sub-Contractors intend to execute the Work in the sequence indicated on such schedule;

.2 Contractor has distributed the proposed schedule to its Sub-Contractors for their review and comment, and has obtained their concurrence;

.3 All elements of the Work required for the performance of the Contract are included. Failure to include any such element shall not excuse the Contractor from completing the Work within the Contract Time and within any other constraints specified in the Contract;

.4 Seasonal weather conditions have been considered and included in the planning and scheduling of the Work influenced by high and low ambient temperatures and/or precipitation;

.5 Contractor has thoroughly inspected the Site and has incorporated any other special conditions in planning the Work such as specified or required non-work periods, etc.

.6 Consultant review time of submittals and shop drawings as specified has been accounted for in project schedule.

.8 The Contractor shall provide look-ahead schedules for specific Work activities to be performed in the period leading to the next field meeting.

.9 If any activities are overrunning estimated time, the Contractor shall indicate what corrective measures shall be taken to bring them back on schedule.

.10 The Contractor shall identify any aspect which shall cause delay, or potential for delay, before it becomes a delay and indicate what mitigating action needs to be undertaken to maintain schedule.

.11 The Contractor's Work schedule shall be updated at least every two weeks and distributed to all Persons who are activity listed. Such Work schedule shall include the percentage complete of each activity.

.12 The Contractor shall submit copies of each issue of schedules with monthly applications for payment (two sets of schedules per month).

.13 Cash Flow Schedule: The Contractor shall prepare a proposed cash flow schedule in horizontal bar chart form. The cash flow schedule shall coincide with the construction progress schedule and shall project monthly progress draws for the FMAA's financial planning purposes

.1 Cash flow diagram:

.1 Contractor shall submit an updated cash flow diagram quarterly.

.2 Cash flow diagram shall be in format acceptable to the FMAA Project Manager.

.3 Cash flow diagram shall represent Contractor's anticipated invoicing.

1.4 QUALITY ASSURANCE

.1 Use experienced personnel, fully qualified in planning and scheduling to provide services from the commencement of the Work through to the issuance of the Completion Payment Certificate.

1.5 WORK BREAKDOWN STRUCTURE (WBS)

.1 Prepare construction Work Breakdown Structure (WBS) within ten (10) working days of Award of Contract date.

1.6 PROJECT MILESTONES

.1 Mandatory and recommended project milestones form targets for both Master Schedule and Detail Schedule of CPM construction network system.

1.7 PRELIMINARY AS-PLANNED SCHEDULE

.1 Meet with FMAA Project Manager and Consultant within five (5) working days of Contract award, to discuss proposed approach for undertaking the Work, inclusive of methodology, sequencing, Construction Equipment, and labour resources to be utilized.

.2 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.

.3 Prepare a detailed CPM schedule (the preliminary as-planned schedule), illustrating the Contractor's plan for executing the Work, indicating the times for starting and completing the various stages of the Work and any applicable constraints. The preliminary as planned schedule should refine and amplify the Contractor's tender schedule and must provide sufficient detail of the critical events and their interrelationship to demonstrate that the Work will be performed within the Contract Time.

.4 The preliminary as-planned schedule shall cover all phases of the Work, and shall represent a practical plan to complete the Work, considering restrictions of access and availability of Work areas, and availability and use of manpower, materials and equipment. The preliminary as-planned schedule shall show the activity duration, sequencing and interdependencies for the following:

.1 Preparation of Shop Drawings and material samples;

.2 Review and approval of Shop Drawings and material samples;

.3 Permitting;

.4 Material procurement;

.5 Fabrication;

.6 Temporary works;

.7 Installation;

.8 Inspection/testing; and

.9 Handover.

.5 Each activity shall be coded by the performing entity such as a particular Sub-Contractor, supplier, the Consultant, etc.

.6 The activities defined in the preliminary as-planned schedule shall represent the planned durations in anticipation of normal manpower and equipment utilization in durations of whole working days. Except for non-construction activities, such as procurement, delivery or submittals, no activity durations shall exceed fifteen (15) working days unless approved by the Consultant. The durations shall be determined based upon resource planning under contractually-defined on-site work conditions. In calculating activity durations, normal inclement weather shall be considered. The Contractor shall schedule the Work to minimize the effect of adverse weather, and to allow for protection of the Site from such effects.

.7 The total number of activities and the distribution of activities shall reflect the complexity of the Work and shall be finite, measurable, identify a specific function and identify a trade responsible for its completion.

.8 Prepare a narrative to accompany the preliminary as-planned schedule that provides a detailed description of the labour, materials, plant, means and methods that the Contractor intends to utilize in carrying out the Work to achieve the planned rates of production required to support the activity durations shown in the schedule. The narrative shall also provide explanations supporting the use of lead-lag relationships and, where permitted, constrained dates.

1.8 PRELIMINARY AS-PLANNED SCHEDULE SUBMISSION AND REVIEW

.1 Within fifteen (15) working days after Contract award, submit to the Consultant:

.1 One (1) electronic copy of the preliminary as-planned schedule, clearly labelled with data date, specific update, and person responsible for update.

.2 One (1) electronic copy of bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.

.3 One (1) electronic copy of network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.

.4 One (1) electronic copy of written narrative as described in paragraph 1.5.7 above.

.2 The FMAA Project Manager and the Consultant will review and return the preliminary as-planned schedule within five (5) working days after receipt.

.3 The preliminary as-planned schedule must be acceptable in principle to the FMAA Project Manager and the Consultant, prior to the release of the first progress payment.

1.9 FINAL AS-PLANNED SCHEDULE AND CASH FLOW

.1 The Contractor shall submit all revisions and/or additional information requested by the FMAA Project Manager or the Consultant pursuant to their review of the preliminary as-planned schedule if the Consultant considers that these additions are necessary for the preliminary as-planned schedule to comply with the requirements of this section. The required revisions must be made and the as-planned schedule finalized to the satisfaction of the FMAA Project Manager and the Consultant (whereupon it will become the final as-planned schedule, against which progress will be measured) within thirty (30) working days after Contract Award.

.2 The cash flow schedule shall coincide with the construction progress schedule and shall project monthly progress draws for the FMAA's financial planning purposes.

1.10 FINAL AS-PLANNED SCHEDULE SUBMISSION, REVIEW AND APPROVAL

.1 The Consultant will accept the final as-planned schedule if it demonstrates that the Work will be performed in an orderly manner and in conformity with the Contract Time, subject to the constraints set out in the Contract, but such acceptance will neither impose on the FMAA Project Manager or the Consultant responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve the Contractor from the Contractor’s full responsibility, therefore.

Acceptance of the final as-planned schedule or any subsequent update by the FMAA Project Manager shall not be construed as a confirmation that the schedule is a reasonable plan for performing the Work.

.2 Acceptance of final as-planned schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract Time.

.3 Consider final as-planned schedule showing Work completed in less than specified Contract duration, to have float.

1.11 COMPLIANCE WITH CONTRACT SCHEDULE

.1 The Contractor shall adhere to latest schedule approved by the Consultant.

.2 The express or implied acceptance by the FMAA Project Manager or the Consultant of the final as-planned schedule and any progress schedules shall not constitute an approval or acceptance of the Contractor's construction means, methods, or sequencing or its ability to complete the work in a timely manner, and shall not place any obligation or responsibility on FMAA Project Manager towards the Contractor nor in any way limit the Contractor's obligations and responsibilities.

.3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.

.1 Corrective measures may include:

.1 Increase of personnel on site for effected activities or work package.

.2 Increase in materials and equipment.

.3 Overtime or Additional work shifts.

.4 Submit to Consultant, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. Include as part of supporting evidence:

.1 Written submission of proof of delay based on revised activity logic, duration, and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.

.2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.

.3 Other supporting evidence requested by Consultant.

.4 Do not assume approval of Contract extension prior to receipt of written approval from Consultant.

.5 In event of Contract extension, display in Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.

.1 Consultant will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.

.2 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

1.12 PROGRESS MONITORING

.1 Monitor progress of Work in detail to ensure integrity of critical path, by comparing actual completions of individual activities with their scheduled completions, and reviewing progress of activities that have started but are not yet completed. Monitoring should be undertaken sufficiently often so that causes of delays are immediately identified and removed if possible.

.2 On an ongoing basis, record "progress to date" on copy of schedule to be available at the Site. Inspect Work with the FMAA Project Manager and the Consultant at least bi-weekly to establish progress on each current activity.

.3 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.

.4 Perform Detail Schedule update monthly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic, and duration changes.

.5 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.

.6 Submit to Consultant copies of updated Detail Schedule.

.7 Requirements for monthly progress monitoring and reporting are basis for progress payment request.

.8 Submit monthly written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:

.1 Description of progress made.

.2 Pending items and status of permits, shop drawings, change orders, possible time extensions, etc.

.3 Status of Contract completion date and milestones.

.4 Current and anticipated problem areas, potential delays, and corrective measures.

.5 Review of progress and status of Critical Path activities

1.13 UPDATES AND REVISIONS TO SCHEDULE

.1 The Contractor’s schedule is to be updated and resubmitted to the Consultant as a progress schedule at least once per month, on a date to be mutually agreed by the Contractor and the Consultant, together with the related data and reports required by this Section. Updated schedule is to include a 2 week look-ahead schedule in the form of a bar chart.

.2 Each progress schedule shall record and report actual completion and/or start dates for each completed or in-progress activity, activity percent complete for in-progress activities and forecast completion dates for all activities that are not yet complete. Do not automatically update actual start and finish dates by using default mechanisms found in scheduling software. The progress schedule will show the projected completion date of the Work based on the progress information inserted into it, without changes to the schedule logic or the original duration of any activity. The Contractor shall use the retained logic option when executing schedule calculations. The final as-planned schedule (or an approved revision thereto) will be shown as a target schedule to indicate whether the current progress schedule remains on target, has slipped or is ahead of schedule.

.3 The Contractor may then, in a second and subsequent update to the progress schedule, incorporate any logic and duration changes that represent its revised planning, provided all such changes are identified and documented in the schedule narrative required to accompany the progress schedule, and are agreed to by the Consultant.

.4 If it appears that the progress schedule submitted by the Contractor no longer represents the actual sequencing and progress of the Work, the Consultant may instruct the Contractor to revise the progress schedule.

.5 In order to improve the schedule, eliminate unforeseen problems or reduce the time required for an activity, modifications to the schedule may be suggested by the Contractor, Sub-Contractors,

FMAA Project Manager or Consultant during the execution of the Contract, and such modifications may be implemented by mutual agreement. The Contractor shall submit to the Consultant for acceptance proposed adjustments to the final as-planned schedule or any subsequent updates that will not change the Contract Time.

.6 If, at any time, the work is behind schedule with respect to the progress schedule currently in force, and if the Consultant believes there is a risk of the Work not being completed within the Contract Time as a result of such delay, the Contractor shall take all necessary measures to make up for such delay either by increasing staff, plant or facilities, or by amending its work methods, whichever is applicable.

.7 In all cases of delay or potential delay, the Contractor shall keep the FMAA Project Manager and the Consultant informed of its intentions with regard to mitigation of such delay and the FMAA Project Manager and Consultant may, if it is deemed necessary, require the Contractor to revise all or part of its current progress schedule.

.8 The current Contract Schedule can only be revised as agreed with the FMAA Project Manager and the Consultant by Change Order or an accepted revision to the logical sequence of described construction operations.

.9 Once accepted, the revised schedule will become the current Contract Schedule against which progress is reported and to which subsequent updates will be compared. The new Contract Schedule will be clearly identified to show it as the current Contract Schedule.

.10 Where the progress schedule shows completion of the Contract, or of any interim milestone, later than the Contract or milestone completion dates, acceptance of such progress schedules and of the monthly progress report will not constitute acceptance of the delay by the Consultant or the FMAA Project Manager.

1.14 EXTENSIONS OF TIME

.1 Float shall not be for the exclusive use of either the Contractor or the FMAA Project Manager. Extensions to the Contract Time will be granted only to the extent that appropriate adjustments to the duration of the affected activity exceed the total float time along the affected paths of the progress schedule in force at the time a Change Order or Change Directive is issued.

.2 Submit to the Consultant, justification, project schedule data and supporting evidence for approval of extension to the Contract Time or interim milestone date when required. Include as part of supporting evidence:

.1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved Contract Schedule.

.2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.

.3 Other supporting evidence requested by the Consultant.

1.15 PROGRESS REPORTS

.1 Monthly progress reports shall be prepared by the Contractor and submitted to the Consultant in the form of one (1) electronic copy of the relevant schedule files, to demonstrate how the Work is actually progressing and the planned and detailed sequencing of the Work at the time of the report. The cut-off date for the monthly progress report shall be as instructed by the Consultant and the report shall be submitted no later than ten (10) Working Days after the cut-off date and accompanying the monthly progress draw.

.2 Each monthly progress report shall be in a format acceptable to the FMAA Project Manager, and shall be arranged according to the following headings and sub-headings:

.1 Executive Summary.

.1 Activity to (date).

.2 Forecast activity to (date).

.2 Project Cost Information:

.1 Budget Summary.

.2 Cash Allowance Log.

.3 Change Order Log.

.3 Project Data:

.1 Project Schedule.

.2 Shop Drawing Log.

.3 Site Inspection Log.

.4 Site Testing Log.

.4 Critical Issues Log.

.5 Site Photos.

.3 Each monthly progress report shall include:

.1 An updated progress schedule, comparing actual and target progress for all milestones and activities. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.

.2 Criticality report listing activities and milestones with up to five (5) days of total float used as first sort for ready identification of near critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

.3 Progress report in early start sequence, listing for each trade, activities due to start, to be underway, or finished within two months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

.4 A schedule narrative, including:

.1 Detailed descriptions of progress, including each stage of procurement, fabrication, delivery to site, construction, installation, and testing;

.2 Discussion of the basis for any work sequencing, logic, interdependencies or original activity duration revisions incorporated into an updated progress schedule; and

.3 Comparisons of actual and planned progress, with a brief commentary on any actual or forecast delays or problems that might have an impact on the completion. date of the Work, and a discussion of the measures being (or to be) adopted to overcome these.

.5 Charts showing the status of submittals, permits and approvals, utility relocations, purchase orders, manufacturing/fabrication and construction.

.6 For each fabricated item, the name and location of the fabricator, percentage progress, and the actual or expected dates of commencement of fabrication, Contractor's inspections, tests and delivery.

.7 Progress photographs taken, prepared, and submitted in formats specified, all in accordance with Section 01 33 00 – Submittal Procedures.

.8 RFI log.

.4 Timely submission of updates is of significant and crucial importance to the management of this project. Lack of or late receipt of updates diminishes their value to the FMAA Project Manager and the Consultant. Therefore, if the Contractor fails to submit any progress schedule or required revision to a progress schedule within the prescribed time period, the FMAA Project Manager, in its sole discretion, may hold back subsequent progress payments until the updated schedule is submitted or the revision is accepted.

1.16 REVIEW OF MONTHLY PROGRESS REPORTS

.1 The monthly progress reports and progress schedules will be used by the FMAA Project Manager and the Consultant to monitor the Contractor's performance against the current Contract Schedule.

2 Products

Not Used

3 Execution

NOT USED

END OF SECTION

1 General

1.1 ADMINISTRATIVE

.1 Make submissions reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

.6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.10 Keep one reviewed copy of each submission on site.

.11 Submit all submittals other than samples as one (1) single electronic PDF file.

.12 Name Submittal PDF files to include the following:

.1 Submittal Number.

.2 Spec Section Number.

.3 Revision Number: Reflect the number of submissions, zero is indicating the first submission.

.4 Description of Submission.

.5 Example: Sub001_09 21 16_R0_Gypsum Wallboard Product Data.

.13 Submittals returned to the Contractor will have added text to the end of the file name indicating the review status of the Submittal.

.1 Example: Sub001_09 21 16_R0_Gypsum Wallboard Product Data – [review status].

.14 Resubmit submittal shall maintain the original file name but revising the revision number.

.1 Example: Sub001_09 21 16_R1_Gypsum Wallboard Product Data.

1.2 SUBMISSIONS SCHEDULE

.1 Within four (4) weeks after award of Contract submit a submittal schedule itemizing submittal for review by Consultant.

.2 If either the contractor or the consultant so requests, they shall jointly prepare a schedule fixing the dates for submission and return of submittals.

.3 Allow fourteen (14) days for Consultant's review of each submission.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term shop drawings means drawings, diagrams, illustrations, schedules, performance charts, product data, brochures and other data which are to be provided by the contractor to illustrate details of a portion of the work.

.2 Arrange for the preparation of clearly identified shop drawings as the consultant may reasonably request.

.3 Prior to submission to the consultant, review all shop drawings. By this review the contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data or will do so and that he has checked and coordinated each shop drawing with the requirements of the work and of the contract documents. Indicate the contractor's review of each shop drawing by stamp, date and signature of an authorized person.

.4 Submit shop drawings to the consultant for his review with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of other contractors.

.5 Make changes in shop drawings which the consultant may require consistent with the contract documents and resubmit unless otherwise directed by the consultant. When resubmitting, notify the consultant in writing of any revision other than those requested by the consultant.

.6 Make shop drawings accurately to a scale sufficiently large to show pertinent features of the Work. Define the division of responsibility between different trades in the shop drawings.

.7 Show materials, methods of construction and attachment or anchorage, erection diagrams, connections and other details necessary to complete the work. Cross reference shop drawings to drawings and specifications.

.8 The review by the consultant is for the sole purpose of ascertaining conformance with the general design concept. The review shall not mean that the consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the contractor, and such review shall not relieve the contractor 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 processes or to techniques of construction and installation and for co-ordination of the work of all subtrades and work of other contractors.

.9 Any adjustments made on the shop drawings by the consultant are not intended to change the contract price. If the contractor deems that such adjustments effect the value of the work, he shall so state in writing before proceeding with the fabrication and installation of the work.

2 Products

2.1 TRANSMITTAL LETTER

.1 Accompany submissions with transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Identification for initial submission or resubmission.

.6 Other pertinent data.

2.2 SHOP DRAWINGS

.1 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.2 Shop Drawings: Submit one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.

.3 Product Data: Submit one (1) electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.4 Delete information not applicable to project.

.5 Supplement standard information to provide details applicable to project.

.6 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.7 Shop drawings will be returned to the Contractor with one of the following notations:

.1 When stamped "REVIEWED", distribute additional copies as required for execution of the Work.

.2 When stamped "REVIEWED AS NOTED", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

.3 When stamped "REVISE AND RE-SUBMIT", make the necessary revisions, consistent with the Contract Documents and submit again for review.

.8 Only use shop drawings bearing "REVIEWED" or "REVIEWED AS NOTED" on the Work unless otherwise authorized by the Consultant.

.9 Further revisions by Contractor on submittals bearing "REVIEWED" or "REVIEWED AS NOTED" are not permitted.

.10 Shop Drawings Indicating Engineering and Design to be Provided by the Contractor: Include seal and signature of a Professional Engineer registered in the Province of the Work.

2.3 PRODUCT DATA SHEETS

.1 Manufacturer's standard schematics, catalogue sheets, diagrams, schedules, performance charts, illustrations, and other descriptive data shall be acceptable in lieu of shop drawings, where specified.

.2 Product data sheets shall be acceptable, provided they conform to the following:

.1 Information not applicable to the Work has been deleted.

.2 Supplement standard information to provide additional information applicable to the Work.

.3 Dimensions and clearances required are set forth.

.4 Performance characteristics and capacities are set forth.

.5 Wiring diagrams and controls are set forth.

.3 Where shop drawings shall not be prepared due to standardized manufacture of product, the Contractor shall submit product data sheets or brochures for requirements requested in Plans and Specifications Sections and as the FMAA may reasonably request.

.4 The Contractor shall submit copies of all WHMIS data sheets.

.5 The Contractor shall submit all product data sheets electronically via emails in PDF format

2.4 SAMPLES

.1 At each major milestone stage, assemble and submit all relevant samples in context, at one time, in the following groups:

.1 Exterior Materials and Finishes

.2 Interior Materials and Finishes

.3 Ceiling Systems and Light Fixtures.

.4 Door Hardware

.5 Cover plates, grilles, etc., of Mechanical and Electrical Sections.

.2 Submit for review samples in triplicate as requested in respective specification Sections and as Consultant may reasonably request. Label samples with origin and intended use.

.1 Technical specifications section.

.2 Product manufacturer’s name and address.

.3 Product supplier’s name and address.

.3 Deliver samples prepaid to Consultant's business address.

.4 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.5 Unless custom or precise colour and pattern is specifically described in the Contract Documents, whenever a choice of colour or pattern is available in a product, submit accurate colour charts from the manufacturer's standard range of colour and pattern charts to the Consultant for selection.

.1 Unless all available colours and patterns have identical costs and identical wearing capabilities and are identically suited for the installation, completely describe the relative costs and capabilities of each.

.6 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.7 Make changes in samples which Consultant may require, consistent with Contract Documents.

.8 Reviewed and accepted samples will become standard of quality of work and material against which installed Work will be verified.

2.5 PRE-CONSTRUCTION CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract and prior to commencing work, submit the following:

.1 Workplace Safety and Insurance Board status.

.2 Certified true copy of insurance.

2.6 TEST REPORTS

.1 Clearly show on each test reports or certification, the name and location of the Work, name and address of Contractor, quantity and date of shipment and delivery, and name of manufacturer or fabricating company. Ensure certificates are signed by an authorized representative of the manufacturing or fabricating company.

.2 Submit four (4) hard copies, or one (1) electronic copy of all test reports submitted with certificates of compliance showing date or dates of testing, the specified requirements for which the testing was performed and results of the test or tests.

2.7 CERTIFICATION OF PERSONNEL

.1 Provide certificates to establish qualifications of personnel employed on the Work where such certification is required by authorities having jurisdiction, by the Consultant or by the Contract Documents.

3 Execution

3.1 SUBMISSION

.1 Make submittals well in advance of schedule dates for fabrication, manufacture, erection and installation to provide adequate time for reviews, securing necessary approvals, possible revisions and resubmittals, placing orders, securing delivery and to avoid construction delays.

3.2 RETURN OF SUBMISSIONS

.1 If, upon review by the FMAA, no errors or omissions are discovered or if only minor corrections are made, the shop drawing of the product data in PDF format labelled with Engineer's stamp "Reviewed No Comments" or "Revise as noted" shall be returned to the Contractor electronically via email and fabrication and performance of the Work shall proceed.

.2 If shop drawings or data sheets are rejected, a noted copy shall be returned to the Contractor and the Contractor shall resubmit corrected shop drawings or data sheets through the same procedure indicated above before performance of the Work may proceed.

.3 Unless stated elsewhere in the specification, the Consultant shall review and return submissions within ten (10) business days of receipt from the Contractor.

.4 Distribution of Submittals after Review

.1 The Contractor shall distribute copies of shop drawings and product data which carry the stamp of the FMAA's consultant as follows (where applicable):

.1 Job site file (Record documents),

.2 Contractor's office,

.3 Subcontractors, and

.4 Suppliers or fabricators.

END OF SECTION

1 General

1.1 AIRPORT CONSTRUCTION

.1 All construction Work at the Airport shall be performed in accordance with the current FMAA construction guidelines and its associated standards, regulations and procedures manuals.

.2 Unless otherwise specified or directed, the Contractor shall comply with FMAA requirements with respect to FMAA maintained buildings, other buildings and areas, movement of vehicles and materials, hauling, operational restrictions, access restrictions, access to construction, protection of Work in progress, housekeeping, cleaning, protection of public services, streets and roads, utility damage protection and utility locates.

1.2 AIRPORT OPERATIONS

.1 Ensure that the Work shall not disrupt airport operations at any time, except as authorized by the FMAA airport operations authority.

.2 Coordinate the Work through the FMAA Project Manager and the airport operations authority with notifications to the Integrated Operations Control Centre (IOCC) and as specified in the current FMAA construction guidelines.

.3 Provide temporary facilities and controls for the protection of construction workers, the public, airport personnel, airport property, and adjacent public property. The Contractor shall comply with all Division 01 sections and the requirements of current FMAA construction guidelines.

.4 Comply with the following operational restrictions and constraints with regards to the execution of the Work:

.1 The integrity of all electronic and visual navigational aids associated with live aviation activities for aircraft operations shall be maintained at all times and take precedence over construction Work operations.

.2 Construction Work and equipment shall not impair the visual acuity or line-of-sight of air traffic controllers operating from the control tower.

.3 Operational restrictions shall affect the scheduling of the Work. Construction activities which may interfere with operations on existing runways, taxiways and aprons shall be scheduled only during periods when these operating surfaces are not in service.

.4 Physical and visual impediments to runway, taxiway and apron operations shall be avoided when the manoeuvring surfaces are in service. Physical intrusions, where allowed by the FMAA, shall comply with the airport zoning regulations. Any unanticipated violations of zoning found unavoidable during the course of the Work, and not specifically addressed in the Contract, shall be coordinated with the IOCC a minimum of ten (10) days in advance of such Work.

.5 Visual impediments, such as dust or fixed objects, must not be allowed to interfere with the line-of-sight from the Control Tower to airfield operations or interfere with the electronic equipment such as the Instrument Landing System (ILS). Authorized physical intrusions shall have their highest points marked by red obstruction lights and shall be confirmed and coordinated by the Engineer.

.6 Emergency Services mobility must be preserved at all times. Operating routes must be reviewed by the Engineer on a bi-weekly basis to ensure that access is maintained at all times. Alternative and approved routes are to be established if new construction is anticipated to interfere with such access areas.

.7 Where low visibility operations are in effect, the area shall be sterile prior to commencing low visibility operations. During low visibility operations, all Work in an affected area shall stop, and all equipment and personnel must leave the affected area. The Contractor shall

be solely responsible to determine from the Airport Construction Coordinator at the commencement of the Work what areas may be affected.

.8 Cranes and hoisting equipment shall not be erected without first applying for and obtaining a "Crane Permit" from the FMAA.

.1 Set cranes height to be limited and not more than 30m; prior approval is required if there is a request to deviate from this requirement

1.3 PARKING

.1 Coordinate all parking requirements with the FMAA. Parking spaces shall be provided or authorized by FMAA permit only. Parking for Contractor's personal vehicles shall be provided in the Contractor's yard or other designated landside area(s) only.

.2 No personal vehicle is allowed on the Work site. Only those vehicles required for the execution of the Work are allowed on the Work site.

1.4 MOVEMENT OF EQUIPMENT AND MATERIALS

.1 Where Work occurs within terminal buildings, comply with the airport logistics program with respect to the movement of all construction related equipment and materials. Coordinate with FMAA representative and as specified in Section 01 31 13 – Project Coordination.

1.5 AIRSIDE AREAS

.1 Where Work is to occur in airside areas of the airport, the Contractor shall:

.1 Comply with the current FMAA construction guideline.

.2 Obtain the approval of the FMAA representative for scheduling of Work.

.3 Control movements of equipment and personnel as directed by the FMAA representative.

.4 Comply with the security and escort requirements as required in the FMAA guidelines.

.5 Ensure that vehicles conform to the Airside Vehicle Operators Permit (AVOP) and vehicle licensing and marker requirements. Where Contractor's personnel do not have a valid AVOP and airside vehicle license, vehicles shall be escorted or under surveillance by an approved security company.

1.6 AIRPORT UTILITIES

.1 Comply with the utilities locate procedures as specified in the current FMAA construction guideline or as directed by FMAA representative.

.2 For Work in areas adjacent to airport lands, the Contractor shall contact the local utility companies in advance to obtain locations of all underground utilities prior to Work. The Contractor shall be responsible to pay all costs of this locating service.

.3 For construction on airport lands, the Contractor shall in advance contact with FMAA representative for FMAA utilities locator to obtain location and marking services for all utilities. FMAA shall pay costs of this locating service for initial locates only. Where location markers are removed, lost or destroyed as a result of actions by the Contractor or its Subcontractor(s), the cost of re-locating and re-establishing markers shall be borne by the Contractor.

.4 Ensure that all personnel and all Subcontractors are aware of utility locations and that they have a copy of the locate sheet(s) prior to excavation.

.5 Prior to machine excavation, expose all adjacent identified, marked and staked utilities by non-destructive means, including the use of hydro-vacuum excavating or equivalent method so as not to damage existing utilities.

.6 When damaged existing utility occurred, suspend operations immediately and advise the FMAA representative.

.7 Repair the damage to any utility and bear all associated costs resulting from such damage.

1.7 AIRPORT SYSTEMS SHUT-DOWN

.1 Comply with the current FMAA construction guidelines for shut-down and interruption of all airport systems that are controlled and monitored by the FMAA, as well as any tenant systems that could impact, impair or otherwise disrupt FMAA systems in any way.

.2 Submit a request and obtain FMAA approval for all major systems including: HVAC, plumbing, sprinkler & standpipe, fire alarm, access control, communications, baggage handling, elevator/escalator/moving walkway, power supply, lighting, aircraft fueling, gas, water and fire main and storm and sewage systems.

.3 At the end of each work shift, The Contractor shall reinstate all life safety building systems until the start of subsequent Work shifts whereby another shut-down may be required as part of the original request.

.4 At the completion of modifications and/or additions, the Contractor shall notify the FMAA in order for FMAA to witness the testing and verification of the systems. Further details are set out in Section 01 77 19 – Closeout Requirements.

.5 Report immediately to the IOCC any accidental impairment and disruption of critical systems monitored by IOCC (including the security or fire alarm). The Contractor shall provide the location, cause of the incident, and full contact information of the Contractor.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 GENERAL

.1 This Section provides the Contractor with FMAA expectations for executing the Work in a safe manner. The Contractor is expected to carry out the provisions as stated in this Section during all phases of construction, and identify, assess, and control potential Risks associated with the Work

1.2 HEALTH AND SAFETY MEASURES

.1 Canada Labour Code. Part II (CLC II):

.1 Canada Occupational Safety and Health Regulations.

.2 Canadian Standards Association (CSA).

.3 National Building Code (NBC): Latest edition

.4 FMAA construction guideline.

.5 Alberta Safety Codes.

.6 Workplace Hazardous Materials Information System (WHMIS), RRO 1990, Reg. 860.

.7 In event of conflict between any provisions of above authorities the most stringent provision governs.

1.3 FMAA CONSTRUCTION SAFETY REQUIREMENTS

.1 Follow FMAA and local authorities having jurisdiction safety guidelines and requirements.

.2 Unless otherwise specified or directed, the Contractor shall comply with the following:

.1 FMAA Contractor Safety Audit Program: including scope, application and limitations, procedures, responsibilities within the program, role responsibilities, and Contractor safety policy.

.2 FMAA's Reporting System: including emergency dispatch telephone system, fire department notification, reporting of unsafe conditions, and investigation of occurrences.

.3 Emergency Response Planning: including requirements for Contractor's construction areas and procedures during emergency situations.

.4 FMAA Fire Safety Requirements: including fire protection systems shut-down and restrictions, fire watches for hazardous construction, hot work, welding and cutting permit requirements, open burning flame operations and restrictions, explosive restrictions, fire extinguisher requirements for construction areas, fire hydrant use restrictions, fire route restrictions, compressed gas use restrictions, spray painting restrictions, temporary heat restrictions, and use, handling, storage and disposal of flammable liquids restrictions.

.5 FMAA Construction Safety Requirements: including compliance requirements for personal protection equipment, maintaining exits, construction hoarding and barriers, fall protection, tripping hazards, trash chutes, surface penetrations, fencing for security control, construction dumpsters, electrical work, construction trailers, and confined spaces.

.6 Material Handling Safety: including compliance requirements for asbestos, Workplace Hazardous Materials Information System (WHMIS), outside storage, trash/debris removal, canvas/tarpaulins, equipment, tools and traffic control.

.7 Construction Equipment Lockout: including Contractor's responsibilities with respect to FMAA policy and procedures.

.8 Apply to and obtain from FMAA Emergency Services, a Fire Safety Work Permit.

1.4 CERTIFICATE OF RECOGNITION

.1 The Contractor shall ensure that all work is performed in accordance with FMAA safety requirements, applicable legislation, and good industry practices, the FMAA requires all contractors to be Certificate of Recognition (COR) certified.

.2 It is a requirement for contractors bidding on jobs at FMAA to have COR certification.

.3 By achieving COR, the contractor is to demonstrate that their health and safety management system has been developed, implemented, and evaluated on an annual basis through comprehensive internal and external.

1.5 FMAA CONSTRUCTION SAFETY CONSULTANT

.1 The Contractor shall be aware that the FMAA has engaged an independent Construction Safety Consultant for the purpose of conducting site inspections and auditing of the health and safety plan provided by the Contractor.

.2 The FMAA representative will ensure that safety measures proposed by the Contractor comply with all applicable legislation, regulations and codes and will report any infractions to the FMAA representative for action. The Contractor shall promptly rectify these infractions in accordance with FMAA instructions.

.3 Any inspection by FMAA personnel does not relieve the Contractor from its obligations under the Contract to perform its own safety inspections and to control and be responsible for all health and safety requirements.

.4 The Contractor shall attend the pre-construction meeting at the Place of the Work to discuss health and safety requirements with the FMAA Safety Consultant.

1.6 CONTRACTOR'S RESPONSIBILITY

.1 The Contractor shall be responsible for safety of persons and property on Site and for protection of persons off site and environment to the extent that they may be affected by conduct of Work.

.2 The Contractor shall comply with Section 01 35 27 - Special Procedures - Airport Facilities.

.3 The Contractor shall comply with Section 01 57 00 - Temporary Environmental Controls.

.4 The Contractor shall comply and enforce compliance by employees with safety requirements of Contract documents, applicable laws, statutes, regulations, and ordinances and with site-specific Health and Safety Plans.

1.7 SUBMITTALS

.1 General: The Contractor shall comply with Section 01 33 00 - Submittal Procedures.

.2 Prior to commencement of Work, the Contractor shall submit to FMAA, two copies of Contractor's and Subcontractors':

.1 Notice of Project (Ministry of Labour).

.2 Constructors and Employers Engaged in Construction Registration Form (Ministry of Labour).

.3 Health and Safety Policy and Program.

.4 Site-specific Health and Safety Plan, including:

.1 Project Specific Responsibilities.

.2 Site-specific safety hazard assessment.

.3 Safety and health risk or hazard analysis for site tasks and operations found in work plan.

.4 Fire safety plan in accordance with the National Building Code.

.5 Names and telephone numbers of personnel and alternates responsible for safety and health.

.5 Fire safety plan in accordance with NBC.

.6 Safety communication plan.

.7 Emergency Preparedness Plan.

.8 WCB – Workers Compensation Board.

.9 Clearance certificate from the WCB.

.3 Current On-going Submittals: During the Work (and as requested), the Contractor shall submit the following:

.1 Records of safety meetings.

.2 Copies of reports or directions issued by health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Material Safety Data sheets (MSDS).

.4 The FMAA will review Contractor's site-specific Health and Safety Plan and may provide comments to Contractor. The Contractor shall revise plan as appropriate and resubmit to FMAA.

.5 On award of Contract, the Contractor shall apply to the Emergency Services at FMAA to obtain "Fire Safety Work Permit" as and when required.

.6 Contractor shall be responsible to ensure that all Subcontractors are engaged for their portions of the Work and that they shall submit and/or have available for review copies of all documentation specified above as applicable for the portion of work subcontracted to them.

1.8 SAFETY ASSESSMENT

.1 The Contractor shall perform site-specific safety hazard assessment related to the Work.

.2 The Contractor shall arrange for Locates in accordance with Section 01 35 27 - Special Procedures - Airport Facilities.

1.9 MEETINGS

.1 Pre-construction meetings: The Contractor shall attend health and safety pre-construction meeting.

1.10 OVERLOADING

.1 The Contractor shall ensure no part of Work is subjected to a load which will endanger its stability and safety or will cause permanent deformation.

.2 The Contractor shall ensure that weight of excavated material does not overload or pose a collapse condition upon open trench work.

1.11 SPECIAL PROTECTION AND PRECAUTIONS

.1 The Contractor shall comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of material safety data sheets (MSDS) acceptable to Labour Canada.

1.12 AIRPORT EMERGENCY

.1 In case of any accident or incident involving persons or vehicles, the Contractor shall contact universal emergency number 9-1-1 and FMAA airport emergency department immediately by telephone even if it appears that no injury has been sustained.

.1 FMAA airport emergency department: 780-793-8970

.2 The Contractor shall provide incident report to FMAA within 48 hours of any such accident or incident.

1.13 CONFINED SPACES

.1 Where the Work, or portions of the Work necessitate access to a confined space (trenches, service shafts, tunnels, maintenance holes etc.), the Contractor shall employ personnel specifically trained and certified for such work. Training and certification for Confined Space Entry shall be under a recognized certification program acceptable to the FMAA safety requirement.

.2 The Contractor shall provide all necessary equipment, back-up personnel and supervision necessary to execute confined space activities.

.3 FMAA personnel certified for confined space activity may review confined space work at suitable intervals to completion. This does not relieve the Contractor from any liability or responsibility with respect to confined space procedures or training.

1.14 DESIGNATED SUBSTANCES

.1 Where designated substances, as defined under the regulations of the Alberta Occupational Health and Safety Code, are encountered during the course of construction, all work by the Contractor in the immediate area (of size as defined by the act) shall cease immediately.

.2 The Contractor shall inform the FMAA engineer of the discovery and shall implement procedures outlined in the Alberta Occupational Health and Safety Code for such substances.

1.15 RECORDS

.1 The Contractor shall maintain on a daily basis, safety records as specified under Submittal article, for the duration of the Work and report written results to the FMAA Consultant at each visit and each scheduled meeting.

1.16 ENFORCEMENT

.1 Observing and enforcing safety measures on FMAA's property is considered to be of prime importance to FMAA.

.2 The Contractor shall be aware that progress payments will not be made by the FMAA to the Contractor while any requirement for safety is outstanding.

.3 Directions given by FMAA with respect to action to be taken to correct any deficiencies in safety measures shall be acted upon immediately by the Contractor.

.4 In the event that deficiencies in safety measures are not promptly corrected by the Contractor, the FMAA will take the necessary action for correction purposes and will deduct the cost thereof from monies due or to become due to the Contractor.

1.17 MEASUREMENT PROCEDURES

.1 No payment will be made for compliance with health and safety requirements and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Latest version of Traffic Control Manuals and Guidelines.

1.2 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out the Work or haul materials or equipment.

.2 Road closure permits:

.1 Do not close any lanes of road without prior approval of FMAA Project Manager and authorities having jurisdiction. Submit written request to FMAA Project Manager, including relevant information and details of closure requirements, a minimum of seven (7) days in advance of the date when road closure is required.

.2 Responsible for applying for and obtaining Street Occupation Permit sufficiently in advance of the required road closures so as to cause no delay in the progress of the Work.

.3 Costs for any delays in the Work caused as a result of failure to obtain the necessary road closure permits shall be borne by the Contractor at no increase in either the Contract Price or the Contract Time.

.3 When working on travelled way:

.1 Place equipment in position to present minimum of interference and hazard to traveling public.

.2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.

.3 Do not leave equipment on travelled way overnight.

.4 Before re-routing traffic erect suitable signs and devices in accordance with Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways.

.5 Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.

.1 Provide minimum 7620mm (25') wide temporary roadway for traffic in two-way sections through areas affected by the Work and on detours.

.2 Provide minimum 5486mm (18') wide temporary roadway for traffic in one-way sections through areas affected by the Work and on detours.

.6 Provide and maintain road access and egress to property fronting along the Place of the Work and in other areas as indicated, unless other means of road access exist that meet approval of the FMAA Project Manager.

1.3 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from the Work which requires road user response.

.2 Provide signs, delineators, barricades and miscellaneous warning devices as specified in the Traffic Control Manuals and Guidelines.

.3 Place signs and other devices in locations recommended in the Traffic Control Manuals and Guidelines.

.4 Meet with FMAA Project Manager and Consultant prior to commencement of the Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of FMAA Project Manager and Consultant.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

1.4 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag persons, trained in accordance with, and properly equipped as specified under the Traffic Control Manuals and Guidelines in following situations:

.1 When public traffic is required to pass working vehicles or equipment which block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.7 Delays to public traffic due to contractor's operators: maximum 15 minutes.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 Testing and inspecting services are required to verify compliance with specified requirements. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

.1 Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of products.

.2 Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality control procedures that facilitate compliance with the Contract Document requirements.

.3 Requirements for Contractor to provide quality assurance and quality control services required by Consultant, FMAA Project Manager, or authorities having jurisdiction are not limited by provisions of this Section.

.2 Travel Expenses: Where it is necessary for the Consultant and FMAA Project Manager to visit places away from the Place of the Work in order to supervise, inspect or witness testing activities of items of the Work, for compliance with the Contract Documents, the Contractor shall pay the travelling, lodging and food expenses of Consultant and FMAA Project Manager.

.3 Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Consultant for a decision before proceeding.

1.2 DEFINITIONS

.1 Quality Assurance: Activities, actions, and procedures performed before execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

.2 Quality Control: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Consultant.

.3 Sample Installations: Full-size, physical assemblies that are constructed on-site. Sample installations are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved sample installations establish the standard by which the Work will be judged.

.4 Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

.5 Testing Agency: An independent agency engaged to perform specific tests, inspections, or both.

.6 Experienced: An entity having successfully completed previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 QUALITY ASSURANCE

.1 General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

.2 Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

.3 Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

.4 Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

.5 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

.6 Specialists: Contract Documents may require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated. Requirement for specialists shall not supersede requirements of authorities having jurisdiction.

.7 Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

.8 Manufacturer’s Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

.9 Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

.1 Contractor responsibilities include the following:

.1 Provide test specimens representative of proposed products and construction.

.2 Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

.3 Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

.4 Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.

.5 Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

.6 When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

.2 Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Consultant with copy to Contractor. Interpret

tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

.10 Provide the Work in first class quality, executed by workers experienced and skilled in the respective duties for which they are employed. The Contractor shall immediately notify the FMAA if the required Work is such as to make it impractical to produce the required results.

.11 Do not employ any unfit Person or anyone unskilled in their required duties. The FMAA reserves the right (but shall not be obligated) to require the dismissal from the site of workers deemed incompetent, careless, insubordinate or otherwise objectionable

1.4 QUALITY CONTROL – OWNER'S INSPECTION

.1 FMAA Project Manager shall have access to the Work at all times. If portions of the Work are being fabricated or prepared in places other than the Work site, the Contractor shall arrange access for inspection of such Work.

.2 The Contractor shall give timely notice to the FMAA, and other authorities having jurisdiction for designated inspections. If the Contractor covers, or permits to be covered, portions of the Work designated for tests, inspections or approvals before they are performed, the Contractor shall uncover such Work until necessary testing and/or inspection is completed satisfactorily and then make good all surfaces at the Contractor's expense.

.3 The FMAA may order any part of the Work to be examined if it is suspected to be not in accordance with the requirements of the Contract. If, upon examination such Work is found not in accordance with the requirements of the Contract, the Contractor shall correct such Work and pay the costs of correction and verification. If such Work is found to be in accordance with the requirements of the Contract, the FMAA shall pay the reasonable direct costs of replacement and verification.

1.5 QUALITY CONTROL – INDEPENDENT INSPECTION AGENCIES

.1 Independent inspection/testing agencies shall be engaged by, and the cost of their services paid by, the FMAA for the purpose of quality control and assurance of the Work.

.2 The Contractor shall provide assist and co-operation for execution of inspection and testing services.

.3 Employment of independent inspection/testing agencies shall not relieve the Contractor of its responsibility to perform the Work in accordance with the Contract.

.4 If any defect(s) is revealed as a result of inspection/testing, the FMAA shall request additional inspection/testing to ascertain the full degree of the defect(s). The Contractor shall correct the defect(s) and any further irregularities if so advised by the FMAA at no cost to the FMAA and the Contractor shall pay for retesting and re-inspection.

1.6 QUALITY CONTROL – TESTING AND INSPECTION

.1 The Contractor shall proceed the following procedures:

.1 Notify the FMAA and any appropriate agency in advance so that attendance can be arranged.

.2 Submit samples and/or Materials required for testing with reasonable promptness and in orderly sequence so as to suit the progress of the Work.

.3 Provide labour and facilities to obtain and handle samples and Materials, and provide sufficient space to store and cure test samples.

.2 Reports

.1 Testing or inspection agencies shall submit reports directly to the FMAA, and the Contractor for review.

.2 The Contractor shall distribute copies to the Subcontractor, manufacturer or fabricator of the Work tested.

.3 The Contractor shall furnish test results and mix designs as required.

.3 Earthwork

.1 Inspect and test all earthwork as specified herein. Inspection and testing shall include:

.1 Inspection of excavations for foundations.

.2 Inspection of subgrade and granular fill materials.

.3 Inspection of backfill operations.

.4 Inspection and testing of backfill compaction.

.5 Inspection of trenching and bedding associated with underground services.

.6 Inspection and testing of fill and compaction associated with underground services.

.4 Cast-In-Place Concrete

.1 Inspect and test all cast-in-place concrete as specified herein. Inspection and testing shall include:

.1 Verification of materials delivered to the site.

.2 Slump tests.

.3 Sampling of cylinders, and compressive strength tests.

.5 Asphalt Paving

.1 Inspect and test all asphalt paving as specified herein. Inspection and testing shall include:

.1 Inspection and compaction testing of all granular base courses.

.2 Marshal density testing of asphalt material.

.3 Compaction testing of all courses of asphalt paving.

1.7 QUALITY CONTROL - COMPLIANCE, AND CONTRACTOR'S CONVENIENCE TESTING

.1 Code Compliance Testing: Inspection and tests required by codes or ordinances, or by an authority having jurisdiction shall be the responsibility of the Contractor and shall be paid for by the Contractor.

.2 Contract Compliance Testing: Inspection and tests required by Contract Documents shall be the responsibility of the Contractor and shall be paid for by the Contractor. These services include and not limited to the following:

.1 Mill Tests.

.2 Mix Designs.

.3 Systems Performance, Adjustments and Balancing Reports.

.3 Contractor's Convenience Testing: Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor and paid for by Contractor as part of the Contractor.

.4 Engage a qualified testing agency to perform these quality-control services. Contractor shall not employ same entity engaged by FMAA, unless agreed to in writing by FMAA Project Manager.

.5 Submit a certified written report, in triplicate, of each quality-control service.

.6 Submit additional copies of each written code compliance report directly to authorities having jurisdiction, when they so direct.

.7 Retesting/Reinspecting: Provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with code requirements and Contract Documents. Retesting and reinspection shall be performed by the same testing agency as the initial tests.

.8 Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field-assembled components and equipment installation, including service connections.

1.8 SAMPLE INSTALLATIONS

.1 Construct sample installations for Work specifically requested in specifications. Include for Work of all Sections required to provide sample, installations. Obtain Consultant's approval of sample installations before starting work, fabrication, or construction.

.2 Construct in locations acceptable to Consultant with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.3 Failure to construct sample installations in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.4 If requested, Consultant will assist in preparing a schedule fixing dates for sample installation construction.

.5 Maintain sample installations during construction in an undisturbed condition as a standard for judging the completed Work.

.6 Specification Sections identify whether sample installations may remain as part of Work or to be removed.

1.9 SUBMITTALS

.1 Mill Tests:

.1 Submit mill test certificates as requested or required by the Plans and Specifications.

.2 Equipment and Systems:

.1 Submit adjustment and balancing reports for mechanical and electrical equipment systems in accordance with the Plans and Specifications and the requirements of Section 01 78 00

1.10 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

2.1 TEST AND INSPECTION LOG

.1 Prepare a record of tests and inspections. Include the following:

.1 Date test or inspection was conducted.

.2 Description of the Work tested or inspected.

.3 Date test or inspection results were transmitted to Consultant.

.4 Identification of testing agency or special inspector conducting test or inspection.

.2 Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Consultant's reference during normal working hours.

3 Execution

3.1 REPAIR AND PROTECTION

.1 On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

.2 Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

.3 Protect construction exposed by or for quality-control service activities.

.4 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

3.2 TOLERANCES

.1 Unless more stringent tolerances are required by individual sections of the Plans and Specifications or a standard reference therein, tolerances for installed Work shall be as follows:

.1 Plumb: less than 3mm in 3.0m.

.2 Level: less than 3mm in 3.0m.

.3 Square: 90 degrees ± 10 seconds.

.4 Straight: less than 3mm in 3.0m under a 3.0m straightedge.

3.3 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace in accordance with Contract Documents.

.2 Make good other contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, FMAA may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Consultant.

END OF SECTION

1 General

1.1 CODES AND STANDARDS

.1 The latest edition including all amendments of the following, as the bases for construction on Airport Lands:

.1 National Building Code (NBC).

.2 National Fire Code (NFC).

.3 Alberta legislation – acts, regulations, codes.

.4 Regional Bylaw.

.5 FMAA construction guidelines.

1.2 AUTHORITY HAVING JURISDICTION

.1 The FMAA Construction Control Permit Office (CCPO) is the primary Authority Having Jurisdiction for compliance with all codes and regulations.

.2 Other Authorities Having Jurisdiction outside of the FMAA may be required to review and approve certain portions of the Work. The CCPO will determine the requirements for such involvement.

1.3 PERMITS AND FEES

.1 No construction work may commence without a Facilities Alteration Permit (FAP).

.2 The FMAA shall be responsible for obtaining all necessary information and applying for a Facilities Alteration Permit from the CCPO.

.3 No fees are levied for the Facilities Alteration Permit or other permits issued by the FMAA. Other Authorities Having Jurisdiction outside the FMAA may levy fees for issuing permits under their jurisdiction. The Contractor shall pay all such fees as required, and shall include the cost of such fees in their Contract Price.

.4 Contractor shall furnish certificates and permits from other Authorities Having Jurisdiction when so requested by the CCPO.

.5 The CCPO shall, upon successful completion of FMAA review and approval, issue a Facilities Alteration Permit (FAP).

.6 Prior to commencement of construction, Contractor shall obtain a copy of the Facilities Alteration Permit from the CCPO and post at the Place of the Work.

1.4 RELICS, ANTIQUITIES AND HUMAN REMAINS

.1 Comply with the General Conditions of the Contract with respect to relics, antiquities, and human remains.

.2 Isolate and protect human remains, relics, antiquities, items of historical, archeological or scientific interest such as cornerstones, commemorative plaques, inscribed tablets and other similar objects found during the course of the Work.

.3 If such items are discovered in the course of construction, stop work in the immediate vicinity, and give immediate notice to the FMAA as to the nature of the discovery, and await written instructions before proceeding with work in the area.

.4 Resume work only after the conclusion of any inspection and evaluation by experts engaged by the FMAA, and only after being given permission to do so.

.5 Relics, antiquities and items of historical or specific interest remain Her Majesty's property.

1.5 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not used

3 Execution

Not used

END OF SECTION

1 General

1.1 INSTALLATION AND REMOVAL

.1 Permits: Be responsible for arranging, obtaining and paying for any permit necessary for temporary facilities and controls.

.2 Provide, maintain, and pay for all temporary facilities and controls. Remove them when directed or when no longer required.

1.2 SAFETY PROGRAM

.1 Be responsible to provide full safety program for workers including management, labour, delivery drivers, service personnel and others involved for services on site. Arrange for pre-project meeting related to safety, joint safety inspections, site safety training and safety committees complete with accident investigation procedures.

.2 Prior to commencement of execution of Work, design fire safety plan in conjunction with local Fire Chief. Post fire plan throughout the Work. Do not allow accumulation of waste that may constitute fire hazard.

.3 Comply with requirements of Acts and Regulations with respect to health and safety. Before commencement of Work, and throughout Contract, maintain on site, and readily accessible to all those who may be exposed to hazardous materials, list of hazardous materials proposed for use on Site or Workplace together with current Materials Safety Data Sheet (MSDS).

.4 Ensure hazardous materials used and/or supplied on site are labelled in accordance with WHMIS requirements. Provide detailed written procedures for safe handling, storage and use of such hazardous materials including special precautions, safe clean up and disposal procedures. Conform to Environmental Protection Act for disposal requirements.

.5 Ensure that those who handle, and/or are exposed to, or are likely to handle or be exposed to, hazardous materials are fully instructed and trained in accordance with WHMIS requirements.

.6 Watch work area for minimum of 30 minutes after hot work is completed. Provide Site fire security when required by local building department and/or municipal fire department. Ensure that water supply is adequate for firefighting.

.7 Provide and maintain in working order, suitable Underwriters' labelled fire extinguishers and locate in suitable positions, to approval of authorities having jurisdiction. Such extinguishers shall be maintained to requirements of ULC.

.8 Store all rags and waste containing oil, grease or other flammable materials in an approved metal container and remove from Site at end of each working day.

.9 Only fire-resistant tarpaulins are permitted on Site.

.10 Notify Fire Department and Consultant immediately should a fire of any nature occur whether fire has been extinguished or not.

.11 If any claim is made by anyone against Contractor or any Subcontractor on account of any accident or damage, promptly report facts in writing to FMAA, giving full details of claim.

1.3 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.4 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

1.5 CONTRACTOR'S USE OF SITE

.1 The Work site shall be for the exclusive use of the Contractor except either where the Contractor may interact with other contractors and utility companies or where segments of the Work are accepted as having reached the stage of Substantial Performance of the Work and are suitable for the FMAA's use and occupancy.

.2 The Contractor shall review and be familiar with the work of others and shall make provision in the Contract Price to accommodate any expenses that may be related to such interaction.

.3 The Contractor shall not unreasonably encumber the Work site with Materials and Contractor's Equipment and shall move Materials or Contractor's Equipment which interferes with other contractors, Airport operations, or facilities.

.4 The Contractor shall assume full responsibility for the protection and safe-guarding of the Work under this Contract. The Contractor shall obtain and pay for the use of storage not available on site.

1.6 TEMPORARY FIELD OFFICES

.1 Field Offices: The contractor shall provide prefabricated or mobile units with serviceable finishes, temperature controls as a meeting facility during the construction period. Locate the office as directed by FMAA.

.1 Electrical Power Service: Provide 120V AC duplex receptacles, with not less than one receptacle on each wall of offices and meeting rooms.

.2 Network Data Service: Provide cable or fibre optics path conduit to a lockable cabinet inside the trailer.

.3 Cleaning Services: Employ professional cleaning services to maintain offices in sanitary conditions.

.4 Furniture required for Project site documents including file cabinets, plan tables, plan racks, and bookcases.

.5 Provide two desks not less than 900 mm x 1800 mm (36" x 72") with drawers and two desk chairs.

.6 Conference room of sufficient size to accommodate meetings of 10 individuals. Furnish room with conference table, chairs, and 1200 mm (48") square tack board.

.7 Private washroom with continuous sanitary supplies.

.8 Coffee machine and supplies.

.9 Heating and cooling equipment necessary to maintain a uniform indoor temperature of 20 to 22 deg C.

.10 Lighting fixtures capable of maintaining average illumination of 215 lx (20 fc) at desk height.

.11 Windows and Doors:

.1 Minimum four 900 mm x 1500 mm (36" x 60") windows

.2 One exterior door with lock and three keys and a slot with plywood mail box

.3 One interior door with lock for washroom.

.4 One interior door to conference room.

.12 Maintain in clean condition, paint interior and exterior if necessary.

1.7 CONSTRUCTION AIDS

.1 Construction Hoists: Provide, install, maintain, locate where directed and pay costs for hoisting equipment if required. Equipment shall be positioned so as not to interfere with Work. Operate equipment by qualified hoist operator along with well-trained flag and signal persons. Be responsible for necessary permits and inspection fees. Trade Sections shall make their own financial and schedule arrangements with Contractor for use thereof. Provide concrete pads for hoisting equipment.

.1 Ensure that all crane operating heights are approved in advance as provided for in Section 01 35 27.

.2 Scaffolding: Erect fixed or mobile scaffolding as applicable independent of walls. Use it in manner as to interfere as little as possible with other Sections. When not in use, move it as necessary to permit installation of other work. Construct and maintain scaffolding in rigid, secure and safe manner. Remove it promptly when no longer required.

1.8 CONSTRUCTION SIGNAGE

.1 Provide and erect, within three weeks of signing Contract, a project sign in a location designated by Consultant.

.2 Construct project identification site sign comprising foundation, framing, and one 1200 mm x 2400 mm signboard painted with exhibit lettering produced by a professional sign painter.

.1 Foundations: 15 MPa concrete to CAN/CSA-A23.1 minimum 200 mm x 900 mm deep.

.2 Framework and battens: SPF, pressure treated minimum 89 x 89 mm.

.3 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to CSA O121.

.4 Paint: alkyd enamel to CAN/CGSB-1.59 over exterior alkyd primer to CGSB 1-GP-189.

.5 Fasteners: hot-dip galvanized steel nails and carriage bolts.

.6 Indicate on sign, name of Owner, Consultant and Contractor, of a design style established by Consultant.

.7 Paint all surfaces of signboard and framing with one coat primer and two coats enamel.

.3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Consultant.

.4 No other signs or advertisements, other than warning signs, are permitted on site.

1.9 TEMPORARY LIGHT, POWER AND WATER

.1 Provide and maintain adequate temporary light, power and water as required by all trades for work to proceed without delay at all times of year.

.2 Provide continuous temporary electric power required during execution of Work for temporary lighting, operating of electric pumps, motors, vibrators, power tools, electric cranes, hoists, other equipment and as required.

.3 Maintain illumination on all floors and stairs of minimum 161 lux (15 foot-candles). When finishing trades are performing work, provide illumination comparable to final illumination. Extension cords, lamps and hoses shall be provided by those using them in accordance with governing regulations and ordinances.

.4 Arrange and pay for connection to site trailers including FMAA Engineer's Site Office over Contract duration. Pay for removal of cables and poles, if any, at Contract Completion.

.5 Contractor shall be responsible for maintaining existing light levels during construction. Contractor shall provide temporary lighting at no additional cost to the project, in the event that the scheduled work cannot be completed during the day shift.

.6 Provide a continuous supply of potable water for execution of Work. Ensure adequate pressure at each floor. Provide and maintain temporary water lines, extensions, hoses, and pumps as required.

.7 Be responsible for materials, plant, tools, or equipment on Site.

.8 Do not use any of permanent facilities and controls without obtaining written permission from Consultant.

1.10 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during execution of Work, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where Work is in progress.

.5 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during execution of Work.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.7 Be responsible for damage to Work due to failure in providing adequate heat and protection during execution of Work.

1.11 SANITARY FACILITIES

.1 Existing facilities in nearby building not to be used by the Contractor and all construction workers.

.2 Washroom facilities for all construction workers, as required in temporary field office and in accordance with Applicable Laws.

.3 Keep the area and premises in sanitary condition at all times and as required by health authorities. Empty and/or replace facilities on a regular basis.

1.12 VEHICULAR ACCESS AND PARKING

.1 Access Road, Parking and Traffic Control

.1 Provide access roads as may be necessary to provide safe and adequate access for materials, products, and other supplies. Provide and maintain access sidewalks, roadways, and similar facilities as may be required for access to the Work.

.2 Do not block public roads, or impede traffic during work of this Project and if required to temporary block traffic then provide flag person to direct traffic acceptable to Municipal authorities. Remove accumulations of ice and snow from areas providing access to Site. Ensure that access is available for emergency vehicles. Comply with fire plan for vehicular traffic.

.3 Provide roads, walks, ramps, stairs, and other such means of access, as necessary. Maintain temporary entrances to building(s) including enclosed hoarding as required. Maintain access to existing service entrance(s) at all times, including ready access for fuel oil trucks and delivery vehicles. Bridge excavations with construction to safely support any load that could be imposed or provide personnel to assist in deliveries to building(s) as required.

.4 Do not be nuisance to public traffic any time. Manage construction traffic by using designated roads and by providing trained flag persons to direct public traffic as appropriate.

.5 Maintain temporary roads as required and provide snow removal during the performance of the Work. The Contractor shall remove temporary roads at completion of the performance of the Work and restore all areas to their original condition unless directed otherwise

.6 Maintain such temporary access, including through regular snow and ice removal in winter and wetting to control dust in summer.

.7 Maintain existing roads free of debris, dust, and mud on a daily basis, clean, brush and wash down roads as required daily and protect catch basins and run-off areas with approved filter methods.

.8 Where public roads become contaminated by construction vehicles exiting Airport construction sites, the Contractor shall provide wash-down of contaminated areas of public roads on a regular basis, to the satisfaction of the municipality.

.9 Provide construction warning signs along existing roads used for construction traffic.

.10 Provide detours, ramps, culvert crossings and the like to ensure that traffic is maintained without undue hindrance. The Contractor shall provide signal flag operators, barricades, traffic signals, lights or other devices to protect the public use of the road

.2 Construction Parking: Only those vehicles required for the execution of the Work shall be allowed on the Work site. The Contractor shall review the applicable rules relating thereto with the FMAA. Further details are set out in Section 01 35 27.

1.13 PROTECTION OF PUBLIC TRAFFIC

.1 Unless otherwise directed, the Contractor shall comply with requirements of applicable bylaws, codes, act and FMAA operations department regarding the regulation of traffic or use of roadways.

.2 The Contractor shall provide for and maintain two-way traffic on existing roads, including providing and maintaining paved detour routes, lighting and safety devices, in compliance with local authorities having jurisdiction.

.3 When working on travelled roads, the Contractor shall:

.1 Place equipment in a position so as to present a minimum of interference and hazard to traveling public.

.2 Keep equipment as close together as working conditions permit and preferably on the same side of the travelled way.

.3 Not leave equipment on a travelled way overnight.

.4 Ensure that equipment operators are aware of existing underground and overhead services, including in particular the dangers of overhead power lines, and have the means of protecting these services during the performance of the Work.

.5 Before re-routing traffic, deploy suitable signs, flagmen, and devices in accordance with the requirements of the authority having jurisdiction.

.4 The Contractor shall provide and maintain signal flag operators, traffic signals, barricades and flares, lights, and lanterns as may be required to perform the Work and to safeguard workers, Airport personnel, and the public.

1.14 FIRE ROUTES

.1 All proposed and designated fire routes on the airport shall comply with local regional bylaw, unless otherwise directed.

.2 The Contractor shall establish fire routes to and from buildings and keep them clear at all times. The Contractor shall ensure that vehicles, storage dumpsters, materials and other obstructions shall not block any part of a fire route at any time.

.3 The Contractor shall maintain access to existing buildings and properties, including overhead clearances for emergency response vehicles.

.4 The Contractor shall protect and maintain existing fire routes and new routes, including overhead clearances for use of all emergency response vehicles

1.15 RED OBSTRUCTION LIGHTS

.1 Temporary obstruction lights shall be provided by the Contractor at construction barriers at the following locations:

.1 Runways, taxiways, aprons and all aircraft movement areas.

.2 Contractor shall be responsible for supplying, installing and maintaining all obstruction lighting required to contain the construction area as per Transport Canada Publication TP312 and also in accordance with standards contained within Transport Canada Publication TP382E (Standard Obstruction Markings Manual). This equipment includes but is not limited to:

.1 Red closure marker obstruction light fixtures;

.2 Red retro-reflective markers;

.3 Isolating transformers; and

.4 Cast iron base, lens and couplings

.3 The Contractor shall provide the primary and secondary cables, conduit, polytube, connectors and counterpoise wire, ground wire and other accessories and carry out the installation as directed. The Contractor shall be responsible for maintenance of red closure marker lighting for the duration of the performance of the Work.

.4 The Contractor shall be responsible for all handling and placement of the lights through the performance of the Work, regardless of the number of installations required to suit the Contractor's schedule. The Contractor shall replace damaged lights.

.5 The Contractor shall not connect to electrical circuits without prior approval of the FMAA.

.6 Near completion of the Work, the Contractor shall:

.1 Inspect and verify the extent of lights to be removed and those to be left in place.

.2 Dismantle obstruction lights as directed by the FMAA.

.3 Repair and return to the FMAA all items provided free of charge.

.7 Obstruction lights shall be maintained by the Contractor so that they continue to be fully operational throughout the duration of the Work.

.8 The Contractor shall be responsible for the cost of each item (at current FMAA cost) not returned to the FMAA or returned damaged.

1.16 RETROREFLECTIVE CONES OR TC-54 CONES

.1 Contractor shall install retroreflective cones or TC-54 cones between each red construction light.

.2 Contractor shall black out pavement markings leading to construction area where directed by FMAA, remove black out markings using water blasting method or equivalent approved by FMAA and then reinstate markings upon removal of retroreflective cones or TC-54 cones.

.3 Contractor shall install retroreflective cones or TC-54 cones for closure areas at the start of the full closure or at the start of each work shift, and remove prior to taxiway or runway going back into service.

.4 Contractor shall be responsible for multiple handlings of retroreflective cones or TC-54 cones, for installation, for firmly anchoring down, for maintaining cone alignment where installed, and for replacing damaged cones as directed.

.5 Contractor shall remove retroreflective cones or TC-54 cones at completion of work or as directed.

1.17 SITE STORAGE AND LOADING

.1 The Contractor shall confine Work and operations within the designated site or work area(s). The Contractor shall not unreasonably encumber the site or Work area with products, Material, or equipment.

.2 The Contractor shall neither load, nor permit to be loaded, any part of the site or Work area with a weight or force that will endanger the Work or the site, including the prevention of dropping demolished parts on existing or new floors.

1.18 POLLUTION CONTROL

.1 Take appropriate dust control measures to avoid contamination of adjacent areas near Site from dust. Respond immediately to complaints of dust received from public, authorities, or Consultant. Obtain approval from authorities having jurisdiction before employing chemicals for dust control measures. Haul dusty materials by covered vehicles. Transport wet materials in watertight vehicles. Keep public and private roads free of dust, mud and construction debris resulting from trucks employed on this Project.

1.19 NOISE AND VIBRATION CONTROL

.1 Control noise and vibration generated by Work. Respond immediately to complaints of noise and vibration received from public, authorities, or Consultant.

2 Products

Not used

3 Execution

Not used

END OF SECTION

1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.3 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.4 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.5 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.6 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant locations and installation schedule five days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

2 Products

Not Used

3 Execution

3.1 CONSTRUCTION FENCE

.1 Contractor shall install construction fence in accordance with the local authorities jurisdiction and the current FMAA construction guidelines as directed by FMAA project manager.

.2 Contractor shall black out pavement markings leading to construction area were directed by FMAA, remove black out markings using water blasting method or equivalent approved by FMAA and then reinstate markings upon removal of concrete jersey barriers.

.3 Contractor shall install construction fence for closure areas at the start of the full closure or at the start of each work shift, and remove prior to taxiway or runway going back into service.

.4 Contractor shall be responsible for multiple handlings of construction fence, for installation, for maintaining fence alignment where installed, for relocating fence as directed, and for replacing damaged fence as directed.

.5 Contractor shall remove construction fence at completion of work or as directed.

3.2 PROXIMITY TO SECURITY FENCES

.1 The Contractor shall locate temporary facilities not less than 3.0m on the Landside of a security fence and 1.0m on the 'Airside' of a security fence.

.2 The Contractor shall not park any vehicle, construction equipment, or stockpile of materials within 3.0m of a security fence on the 'Landside' and within 1.0m on the 'Airside.'

3.3 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide as required by governing authorities having jurisdiction.

3.4 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

3.5 DUST TIGHT SCREENS

.1 Provide dust tight screens to localize dust generating activities, and for protection of workers, finished areas of Work and public. Maintain and relocate protection until such work is complete. Coordinate the dust control requirement in Section 01 57 00.

END OF SECTION

1 General

1.1 ENVIRONMENTAL MEASURES

.1 Meet or exceed the requirements of all environmental legislation and regulations including all amendments up to the project date, provided that in any case of conflict or discrepancy, the more stringent requirements shall apply. Provide ongoing reports on procedures for environmental protection.

.2 Meet or exceed the requirements of all Applicable Laws and ISO 14001 relating to environmental matters.

.3 Comply with FMAA environmental requirements for construction and Section 01 57 13 – Temporary Erosion and Sediment Control.

.4 Report all environmental emergencies first to the Airport Emergency Department, and second to the Engineer who will co-ordinate solutions and implementation with the FMAA Environmental Department.

1.2 CONTROL PLAN

.1 Submit to Consultant and FMAA Project Manger of the following for review and approval:

.1 Control plan as specified in Section 01 57 13 – Temporary Erosion and Sediment Control.

.2 Erosion control plan prior to commencing any earthwork.

.3 Soil management plan prior to commencing any earthwork.

.4 Fuel dispensing plan for vehicles and equipment prior to commencement of Work.

.1 Vehicle Fuelling:

.1 Fuelling of vehicles with gasoline is not allowed from tanker trucks.

.2 Fuelling of vehicles with diesel within 7.5m of any building is not allowed.

.3 Fuelling of vehicles with diesel from a tanker having a capacity greater than 3000 liters shall be done in an area capable of containing a 1000L spill.

1.3 ENVIRONMENTAL EMERGENCY RESPONSE PLAN

.1 Prior to commencement of the Work, the Contractor shall submit an Environmental Emergency Response Plan to the FMAA for approval by the FMAA Environment Department.

.2 The Environmental Emergency Response Plan shall include (as a minimum) procedures for contending with the following environmental measures and occurrences:

.1 Storage, removal and disposal of contaminated soil,

.2 Site Drainage,

.3 Protection of Waterways,

.4 Silt Control,

.5 Snow Control,

.6 Spill Control and Management,

.7 Dust Control, and

.8 Reporting and response procedures.

.3 The Contractor shall obtain FMAA approval of the Environmental Emergency Response Plan prior to commencing Work.

1.4 CONTAMINATED SOIL

.1 The Contractor shall notify FMAA Engineer immediately, should contaminated soils be encountered:

.1 Remove soils contaminated with glycol and/or hydrocarbons from the Work site and disposed of in accordance with instructions from the FMAA Environment Department.

.2 Remove soils contaminated by anything other than glycol and/or hydrocarbons from the site and disposed of off Airport lands in accordance with Applicable Laws.

1.5 FIRES

.1 Burn of rubbish is not allowed on site.

1.6 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil, fuel, paint thinner, etc. into waterways, storm or sanitary sewers or soils.

.3 Take necessary precautions and remove from the site and off Airport property any soil contaminated with volatile material.

.4 Notify FMAA immediately whenever contaminants are encountered.

1.7 DRAINAGE, SNOW AND SILT CONTROL

.1 Provide temporary drainage and pumping as necessary during the course of work to keep excavations and site dewatered. Discharge from dewatering operation is to be controlled to minimize erosion and sediment load.

.2 Do not omit ponding or water body at Site due to staging of construction or the sequence of execution of the Work. Clear and maintain Site in a dry condition at all time in duration of the Contract.

.3 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.5 Regularly maintain, clean and replace the drainage, snow and silt measures as required until Total Performance of the Contract.

.6 Prevent silt from entering into existing Storm Water Management (SWM) Facilities. In the event of siltation of these facilities, the Contractor is to remove the silt and restore such facilities at his own cost.

.7 Control discharge from dewatering operations for erosion and sediment loading.

.8 Maintain dry at all times for the duration of the Work those locations on site where water may temporarily pond due to staging of construction; do not permit standing water to remain.

.9 Layout and construct the Work so as to ensure that positive drainage is provided to all drainage points set in their final position in order to prevent ponding or areas not properly drained.

.10 Prior to executing the Work, report to the FMAA in writing any location in which adequate drainage cannot be provided.

1.8 SILT FENCING

.1 The Contractor shall provide silt fence flow checks adjacent to water courses to prevent silt from construction work being carried into the water courses, run-off ditches, catch basins, and the like.

.2 Silt fence shall consist of (as a minimum); 20L/s/m^2 woven polypropylene sedimentation control fabric, 760mm high, supported on 50x50x1220mm wooden stakes at 2280mm o.c. maximum.

.3 The Contractor shall in accordance with section 01 35 27 obtain locates by the FMAA utility locator prior to installing any fencing stakes.

.4 The Contractor shall provide straw bale flow checks in open ditches downstream of discharge points or pumps to filter solids out of the water. If flow from construction is heavy with suspended solids, the Contractor shall install intermediate settlement chamber before allowing water to flow to water courses, ditches, and the like

.5 The Contractor shall provide rock flow checks in open ditches downstream of discharge points or pumps to reduce velocity of flow after water is clear of suspended solids.

.6 The Contractor shall provide straw bale fence or other suitable material collection area to collect and prevent silt entering the water flow beyond the site boundary. The Contractor shall remove and dispose of silt off-site in accordance with a regular program.

.7 The Contractor shall prevent any silt emanating from the construction site from entering any storm water system leading to storm water management facilities. In the event of any such siltation of such facilities, the Contractor shall immediately remove the silt and restore the facility at the Contractor's expense. Failure to comply shall result in others performing the Work and the cost thereof shall be deducted from any monies due to the Contractor under the Contract.

1.9 WORK ADJACENT TO WATERWAYS

.1 As part of the Environmental Emergency Response Plan, detail the means and methods of protecting adjacent waterways and floodplains for the duration of the construction. Include procedures to be followed in order to reduce and control the siltation of drainage courses, ditches and waterways. Show the types and locations of silt barriers, silt fences, flow checks, and the like. The level of siltation entering waterways shall meet or be less than levels required under Applicable Laws. If the planned methodology is found to be insufficient for the purpose, devise a revised plan to meet the requirements. Maintain all parts of the system for the duration of the Work.

.2 Carry out routine inspection of installed flow checks on site, and shall remove and dispose of flow checks that are clogged. Provide replacements to ensure that silt control is effective at all times.

.3 Remove and dispose of all siltation devices and restore banks of water courses and ditches, including grading, topsoil and sodding, upon the conclusion of site Work.

.4 Do not operate construction equipment in waterways without prior approval of the FMAA.

.5 Do not use waterway beds as sources for borrow material.

.6 Do not dump excavated fill, waste material or debris in waterways or floodplains.

.7 Design and construct temporary crossings to minimize erosion to waterways, subject to prior approval of the FMAA.

.8 Do not skid logs or construction materials across waterways.

.9 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.10 Do not blast under water or within 100 meters of indicated spawning beds.

.11 Do not conduct any Work near water beds during spawning season.

1.10 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Provide temporary enclosures to prevent air beyond the site being contaminated by sandblasting, saw-cutting, milling, grinding and other Work creating particulate dust.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris, and provide dust control for temporary roads.

1.11 CONSTRUCTION WASTE

.1 Provide sufficient and suitable refuse containers and dumpsters throughout the site to receive and control construction waste. Keep container lids closed to prevent contents from being blown around the site. Arrange and empty containers in regular basis and as soon as they are 60% full.

.2 Comply with FMAA EMS targets for waste management, recycling, energy conservation, water conservation, spills, etc.

.3 Transport and dispose of all rubbish and waste material off Airport lands in accordance with all Applicable Laws relating to waste management.

.4 Do not burn or bury rubbish or waste material on Airport lands.

.5 Disposal of waste or volatile materials such as mineral spirits, oil or paint thinners into waterways, soils, storm or sanitary sewers. The Contractor shall dispose of such materials off Airport lands in accordance with all applicable laws.

1.12 EQUIPMENT MAINTENANCE AREAS

.1 The Contractor shall perform all on-site equipment maintenance and repair within a designated area in accordance with FMAA requirement.

.2 Follow and use FMAA service logs, leak test notices and decommissioning notices for all equipment.

.3 Prepare and submit for approval, a drawing showing a proposed equipment maintenance area, complete with provision for collecting oil and fuel spills. If watercourse exists nearby, ensure area is located no closer than 30.0 m away from the area.

.4 Obtain approval by the FMAA to perform all equipment maintenance in such defined area.

.5 Locate and grade maintenance area such that surface runoff will not flow out of this area.

.6 Equip site with adequate enclosed containers for the disposal of all refuse resulting from equipment maintenance.

.7 Equip area with adequate materials, equipment and containers to contain and control any spills of hazardous materials. Instructions on dealing with spills, names and phone numbers of persons and agencies to be contacted in the event of a spill must be posted at the site.

.8 Clean up all spills or leaks of equipment fluids, cleaning fluids, fuels, etc. or other solid wastes immediately and shall remove and dispose off-site of any soils contaminated as a result of the Contractor's activities.

.1 All spills involving hazardous waste must be reported to the Airport Emergency Number upon discovery.

.9 Restore areas to original condition at conclusion of the Contract Work.

.10 Do not store fuel in bulk on site to prevent potential fires from affecting Airport operations and to comply with FMAA procedure for fuel dispensing into vehicles and portable equipment to comply

with the National Fire Code of Canada and Canadian Environmental Protection Act (CEPA) Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

.1 Submit fuel dispensing plan for vehicles and equipment to the FMAA Engineer for approval prior to commencement of Work.

.2 Fuelling of vehicles with gasoline is not allowed from tanker trucks.

.3 Fuelling of diesel-fuelled vehicles within 7.5m of any building is not allowed.

.4 Fuelling of diesel-fuelled vehicles from a tanker vehicle having a capacity of over 3000L must be completed in an area capable of containing a 1000L spill.

1.13 NON-MAINTENANCE RELATED SPILLS

.1 Non-maintenance related spills are that occur due to mishandling of fuels during the fuelling process, failure of hoses or other components on equipment and similar or related such events.

.2 As part of its Environmental Emergency Response Plan, the Contractor shall detail the action to be taken and the persons and agencies to be notified in the event of such a spill.

.3 The Contractor shall clean up all spills or leaks of equipment fluids, cleaning fluids, fuels or other hazardous materials in accordance with its Environmental Emergency Response Plan.

.4 The Contractor shall remove from the site and dispose off-site all contaminated materials and soils in compliance with Applicable Laws and the other provisions of this Contract

.5 Responsible for spills which occur due to mishandling of fuels during the fueling process, failure of hoses or other components of equipment, etc.

.6 Submit a contingency plan for dealing with such occurrences to the FMAA Engineer for approval. The plan must describe in detail the action to be taken and the persons and agencies to be notified in the event of such spill.

.1 Report all spills to the FMAA Airport Emergency.

1.14 PROTECTION OF WATERWAYS

.1 Obtain approval by the FMAA, submit a plan detailing the methods of protecting adjacent waterways and floodplains during construction. Include the procedures to be followed to reduce and control the siltation of drainage courses and waterways. Show the types and locations of silt barriers, silt fences, flow checks, energy dissipation, filter fabric for protection of drainage manholes and catch basins, etc. The level of siltation entering waterways must meet Federal, Provincial and Local Guidelines. Have the planned methodology be found to be insufficient to control the siltation problem. Provide and submit immediately an updated plan and take action is necessary to correct the deficiency. Maintain all siltation controls in proper condition until completion of the Contract.

.2 Carry out routine inspection of installed flow checks on site. Remove and dispose of flow checks that are clogged and provide new replacement flow checks to ensure silt control is adequate at all times.

.3 Remove and dispose of all siltation protection devices and restore ditches and other locations to original condition including grading, topsoil and sodding, etc. at conclusion of Contract Work, unless otherwise directed.

1.15 DUST CONTROL

.1 The Contractor acknowledges that dust from construction Work activities creates a serious safety hazard for Airport operations and must be controlled at all times. Absolutely no dust blowing across Airport runways, taxiways, aprons and aircraft operating surfaces shall be tolerated.

.2 Have dust controlling at all times during construction. Dust emission is prohibited and cause serious safety hazard for Airport operations. Absolutely no dust blowing across Airport operating surfaces will be tolerated.

.3 Maintain sufficient watering equipment on site throughout the performance of the Work to control construction dust. The Contractor acknowledges that the FMAA maintains specific hydrants at the Airport for provision of water for such purposes.

.4 No chlorides contained material is permitted on Airport property. Dust control methods or means utilizing or containing chlorides will not be permitted.

.5 The FMAA reserves the right to assess damages against the Contractor for any flight delays resulting from such failure on the part of the Contractor to control dust.

.6 Fail to control dust emissions, the FMAA reserves the right to order the Contractor to cease all operations until adequate measures have been taken to rectify the situation. No delay claim or compensation as a result of the FMAA's direction to stop the Work for this reason.

1.16 WILDLIFE CONTROL

.1 FMAA regards wildlife on the Airport property as a potential hazard to Airport operations and safety. The FMAA's policy is to carry out the Work in a manner that will minimize such hazards.

.2 Keep the Site clean and clear of ponding areas and organic garbage that can be a source of food to attract wildlife. Place organic garbage in containers with lids, remain lid to close all the time when not in use. Empty bin on a daily basis.

1.17 CONTAMINANTS

.1 Soil Management:

.1 Ensure that the FMAA is notified immediately whenever contaminated soils or soils of unusual odour or visual quality are encountered, and assessment of the relative degree of contamination through on site or analytical testing can be made. The FMAA will perform soils testing as requested. Analytical results are to be compared to applicable standards, including federal and provincial.

.2 Ensure that excavated soil exceeding the threshold soil quality criteria for petroleum hydrocarbon/ glycol is transported directly to an approved off Airport property facility. The appropriate soil receiving form shall be completed by the Contractor and approved by the FMAA prior to transporting soil to the facility.

.2 Ensure that any asphalt and/or concrete that is significantly impacted with petroleum hydrocarbon/ glycol is segregated and disposed of off Airport property at an approved landfill site.

.3 Ensure where possible, petroleum hydrocarbon/ glycol impacted soil to be separated from soil which exceeds other parameters (i.e. metals).

.4 Tested soils found below the threshold soil quality criteria, shall be re-used on-site by the Contractor.

.5 Ensure that any petroleum hydrocarbon/ glycol contaminated soil that exceeds the threshold soil quality criteria and cannot be immediately disposed of off Airport property is temporarily stockpiled and covered with a polypropylene tarp (or equivalent) to control odours, dust and erosion.

.6 Ensure that an emergency action plan for spills of pollutants to the natural environment is included where necessary.

.7 The FMAA will audit Work to ensure that the soil management plan is being followed. FMAA Environment Department may choose to audit and verify program performance.

.8 All weigh bills and manifests for materials removed off-site shall be submitted to the FMAA by the Contractor and shall be retained by the FMAA.

.9 On-site activities, quantities and disposal locations of waste shall be compiled in summary report(s) by the Contractor with information submitted by the Contractor, as minimum, on a monthly basis to the FMAA. The report shall indicate the type and amount (%) of petroleum hydrocarbon/ glycol impacted soil transported.

.10 Records: Weekly and monthly monitoring reports identifying Work completed and measures taken to achieve the "Target" shall be produced by the Contractor and submitted to the FMAA.

1.18 ENFORCEMENT

.1 Beware that protection of the environment is considered to be of prime importance during any Work on Airport property.

.2 The Contractor is advised that progress payments for work performed will not be made to the Contractor while any requirement for environmental protection is outstanding.

.3 Directions given by the FMAA with respect to action required to correct environmental deficiencies shall be acted upon immediately by the Contractor.

.4 In the event that deficiencies in the Work are not promptly corrected, the FMAA will take the necessary action for correction purposes and deduct the cost thereof from any monies due, or to become due, to the Contractor.

1.19 MEASUREMENT PROCEDURES

.1 Environmental protection requirements will not be subject to measurement and payment, and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 ENVIRONMENTAL MEASURES

.1 The Contractor shall meet or exceed the requirements of all environmental legislation and regulations including all amendments, as specified in Section 01 57 00 - Temporary Environmental Controls.

.2 All environmental issues encountered by the Contractor shall immediately be brought to the attention of the FMAA Engineer and FMAA Environment Department for implementation.

1.2 CONTROL PLAN

.1 Submit sediment and erosion control plan as part of the Work Plan which, without limitation, shall contain the following:

.1 A key map showing location of site with boundaries, total area in hectares, and scale.

.2 Location and land use of the buildings and facilities adjacent to the site.

.3 Dust control which shall comply with Section 01 57 00.

.4 Location, dimensions and use of the buildings and other structures existing on the site or proposed to be constructed on the site.

.5 Location of ponds, stormwater management facilities (SWM), streams, wetlands, channels, ditches, other water courses, sanitary and stormwater manholes, etc. on and within thirty (30) meters beyond the site boundaries.

.6 Regional Storm Flood and Conservation Authority Fill Regulation Lines and any other relevant restrictions on site, where applicable.

.7 Stratigraphy of predominant soil types and vegetative cover.

.8 Location and dimensions of any existing and proposed stormwater drainage systems and natural drainage patterns on and within thirty (30) meters beyond the site boundary.

.9 Location(s) of any soil or dirt storage pile containing more than one hundred (100) cubic meters of materials.

.10 Location(s) of silt fences, straw bales, rock dams etc.

.11 Existing site topography at a contour interval not to exceed a half (0.5) meter and to extend a minimum of thirty (30) meters beyond the site boundary.

.12 Proposed final elevations of the site with the location and dimensions of all land disturbing activities and temporary stockpiles with their respective schedules.

.13 Location(s) of slopes to be protected and erosion control methods to be implemented.

.14 Location, dimensions, design details and design calculations of all construction site control measures necessary to meet the requirements of this plan.

.15 Provisions for the maintenance of the construction site control measures during construction and during the 12-month maintenance/warranty period.

.16 A schedule of the anticipated starting and completion dates of each land disturbing or land development activity including installation of construction site control measures needed to meet the requirements of this plan.

.17 Any other necessary information with respect to the site.

.2 Comply erosion and sediment control with the Plans and Specifications and as directed by the FMAA Engineer.

.3 Submit Control Plan and certified by a qualified professional engineer who is licensed to practice in the Province of Alberta, or any other qualified person approved in advance by the FMAA Engineer.

.4 Submit for a Control Plan after consideration of the cost of the proposed Work, the anticipated impact on the adjacent body of water or drainage system and the use of the property as requested by the FMAA.

.5 Submit Erosion and sediment Control Plans to meet the site design guidelines and comply with the conditions as specified herein.

.6 Have sedimentation basins and other control measures necessary to meet the requirements of the Control Plan prior to any land disturbance on site. Maintain these measures during the period of land disturbance in a manner satisfactory to the FMAA, in order to ensure adequate compliance with the requirements of this plan and to prevent damage occurring as a result of erosion, sedimentation and flooding.

.7 The FMAA will inspect the site(s) for which Control Plans have been issued for compliance with the approved Control Plan.

.8 Complete site restoration and stabilize the soil mass prior to the removal of erosion and sediment control measures.

1.3 SITE DESIGN CRITERIA

.1 Site Dewatering:

.1 Water pumped from the site shall be treated with appropriate controls to ensure compliance with applicable guidelines and regulations.

.2 If it is demonstrated that water is transparent and has no particles greater than 40 microns, then dewatering operation may be conducted on condition that water is not discharged directly into catch basins or receiving bodies of water or streams.

.3 Ensure erosion control and energy dissipation at discharge points.

.4 Ensure continued compliance by frequent monitoring of operation.

.2 Storm or any other inlets, as the FMAA deems necessary, shall be protected by the Contractor with appropriate erosion control measures that meet acceptable design criteria, standards and specifications acceptable to the FMAA.

.3 The Contractor is advised that applicable criteria to land disturbing activities that result in runoff leaving the site are as follows:

.1 Runoff from adjacent areas passing through the site shall be deviated around disturbed areas, if practicable, and as directed. Otherwise, the channel shall be protected with appropriate measures to reduce sediments reaching the channel.

.2 All activities on site shall be conducted in an approved sequence to minimize the area of bare soil exposed at any one time.

.3 Any storage pile containing more than one hundred (100) cubic meters of material shall not be located within a downslope drainage length less than ten (10) meters away from a roadway or drainage channel. If such pile is intended to remain in place for more than thirty (30) days, it shall be adequately stabilized by the Contractor with a method which shall be subject to FMAA's approval. Erosion from storage piles which are intended to remain in place for less than thirty (30) days shall be controlled with appropriate measures to be installed by the Contractor and approved by the FMAA.

.4 Runoff from the entire disturbed site shall be controlled by the Contractor as specified in Section 01 57 00 - Temporary Environmental Controls.

.4 Control Plan submitted by the Contractor shall contain provisions for a mud tracking prevention program and continual access road cleaning.

.5 All spoils from caisson drilling, boring, tunnelling and other Work shall be deposited into settling ponds constructed on site and that these ponds shall be regularly pumped dry and the selected material disposed of off Airport property according to all relevant legislation. This material shall not be used as load bearing fill. Settling ponds shall be maintained as specified in Section 01 57 00 - Temporary Environmental Controls.

1.4 FORT MCMURRAY AIRPORT AUTHORITY REGULATIONS

.1 The Contractor is an Erosion and Sediment Control Plan Holder and as such shall:

.1 Notify the FMAA within 48 hours of commencing any land disturbing activities.

.2 Notify the FMAA of the completion of any control measures.

.3 Notify the FMAA before dewatering operation on site.

.4 Obtain FMAA's permission, in writing, prior to modifying the approved Control Plan.

.5 Install all control measures as identified in the approved Control Plan.

.6 Maintain road drainage systems, stormwater drainage system, control measures and other facilities identified in the Control Plan.

.7 Repair any siltation or erosion damage to adjoining surfaces and drainage ways resulting from land developing or disturbing activities.

.8 Inspect the construction control measures at least once per week and after each precipitation event of 10 mm or greater and make necessary repairs, if required.

.9 Allow the FMAA to enter the site for the purpose of inspecting for compliance with the Control Plan or performing any Work necessary to bring the site into compliance with the Control Plan.

.10 Maintain a copy of the Control Plan on site.

1.5 ENFORCEMENT

.1 The Contractor is advised that protection of the environment is considered to be of prime importance during any Work on FMAA property.

.2 Progress payments will not be made to the Contractor while any requirement for environmental protection is outstanding.

.3 The Contractor is advised that directions (verbal or written) given to them by the FMAA with respect to action required to correct environmental deficiencies must be acted upon immediately.

.4 In the event that deficiencies in the Work are not promptly corrected by the Contractor, FMAA will take the necessary action for correction purposes and will deduct the cost thereof from any monies due or to become due to the Contractor.

1.6 MEASUREMENT PROCEDURES

.1 No additional payment will be made for requirements under this Section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 GENERAL

.1 Products refer to materials, manufactured components and assemblies, fixtures and equipment incorporated in the work.

.2 As far as practical, favour use of products of Canadian manufacture unless such products are not manufactured in Canada, are specified otherwise, or are not competitive.

.3 Products for use in the Project and on which the Bid was based shall be in production at time of tender date, with a precise model and shop drawings available for viewing.

.4 Where equivalent products are specified, or where alternatives are proposed, these products claimed by the Contractor as equivalent shall be comparable in construction, type, function, quality, performance, and, where applicable, in appearance. Where specified equivalents are used in the Stipulated Price for the work, they shall be subject to final approval.

.5 Incorporate products in the work in strict accordance with Manufacturers' directions, instructions and specifications, where reference is made to them, shall include full information on storing, handling, preparing, mixing, installing, erecting, applying, and other matters concerning the materials that are pertinent to their use and their relationship to materials with which they are incorporated.

.6 Products delivered to the Project site for incorporation in the work shall be considered the property of the FMAA. Maintain protection and security of products stored on the site after payment has been made for them.

.7 Do not install permanently incorporated labels, trademarks and nameplates, in visible locations unless required for operating instructions or by authorities having jurisdiction.

1.2 REFERENCES

.1 Conform with standard references are made within text of specification.

.2 FMAA reserves the right to have such product or system tested to prove or disprove conformance if there is a question as to whether a product or system conforms to the required standard.

.3 Cost for such testing shall be borne by the FMAA in the case of conformance to the Contract or by the Contractor in the event of non-conformance.

.4 Comply with the latest date of issue of referenced standards.

1.3 QUALITY

.1 Products, materials, articles and equipment, referred to collectively as Products, shall be new, not damaged nor defective, and be of the best quality, conforming to the Plans and Specifications, for the purpose intended.

.2 When requested by the FMAA, submit within seven (7) days, the source and quality of products together with the following:

.1 Name and address of manufacturer or supplier.

.2 Trade name, model, and catalogue number.

.3 Performance, descriptive data, test data and test certificates.

.4 Manufacturers or suppliers installation instructions.

.5 Copies of signed purchase orders or other procurement arrangements.

.6 Sample of applicable warranties.

.3 Defective products identified as such prior to completion of the Work, will be rejected regardless of previous review. Review does not relieve the Contractor from the responsibility of installing non-defective products.

.4 Unless otherwise indicated, Contractor shall use products of one manufacturer for material and equipment of same type or classification throughout the construction.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical service rooms.

1.4 AVAILABILITY

.1 Immediately after signing of Contract, Contractor shall review product delivery requirements and anticipate those products which may be long delivery items. Notify the FMAA immediately and propose alternative solutions and suggested alternative products when product impede the construction schedule.

.2 Fail to notify the FMAA in a timely fashion, and not permit the FMAA adequate time to study alternatives, the FMAA reserves the right to select an alternative product or solution of similar character, at no increase in Contract Time or Contract Price.

1.5 PRODUCT HANDLING

.1 Manufacture, pack, ship, deliver and store products so that no damage occurs to structural qualities and finish appearance, nor in any other way detrimental to their function or appearance, or both.

.2 Ensure that products, while transported, stored or installed, are not exposed to an environment which would increase their moisture content beyond the maximum specified.

.3 Schedule early delivery of products to enable work to be executed without delay. Before delivery, arrange for receiving at site.

.4 Deliver and store products at site where directed by the Contractor.

.5 Brace work such as door frames, large window units and similar products to prevent distortion or breakage in handling.

.6 Deliver packaged products, and store until use, in original unopened wrapping or containers, with manufacturer's seals and labels intact.

.7 Label packaged products to describe contents, quantity and other information as specified.

.8 Label fire-rated products to indicate approval of Underwriters' Laboratories.

.9 Product handling requirements may be repeated, and additional requirements specified, in other Sections.

1.6 STORAGE AND PROTECTION

.1 Store products on site with secure protection against all harmful environmental conditions. Prevent damage, adulteration, staining and soiling of materials while stored.

.2 Protect prefinished metal surfaces by protective coatings or wrappings until time of final cleanup specified in Section 01 77 19 – Closeout Requirements. Protection shall be easily removable under work of Section 01 77 19 – Closeout Requirements without damage to finishes.

.3 Store manufactured products in accordance with manufacturers' instructions.

.4 Store steel, lumber, masonry units, and similar products on platforms raised clear of ground.

.5 Store finished products and woodwork under cover at all times.

.6 Do not store products at locations or in such a manner that they damage previously completed work.

.7 Storage and special protection requirements may be repeated and additional requirements specified, in other Sections.

1.7 SCHEDULING OF PRODUCT DELIVERY

.1 Verify that products supplied by all Sections are ordered from suppliers in sufficient time to ensure delivery for incorporation in the work within the time limits established by approved construction schedule.

.2 Obtain confirmed delivery dates from product suppliers.

.3 Immediately inform the Consultant should supplier's confirmation of delivery dates indicate that Project completion may be delayed.

.4 Submit copies of purchase orders and confirmations of delivery dates for products as may be requested.

.5 A schedule of product delivery shall be established and reviewed at each job site meeting.

.6 When deemed necessary, plant visits shall occur by the General Contractor to ensure delivery dates given are true and accurate.

.7 Include cost of transporting all products and equipment for the performance of the Work in the Contract Price.

.8 Include all costs associated with delivering products and materials to the site in accordance with the FMAA requirements.

1.8 DEFECTIVE PRODUCTS AND WORK

.1 Products and work found defective; not in accordance with the Specifications; or defaced or injured through negligence of the Contractor, his employees or Subcontractors, or by fire, weather or any other cause will be rejected for incorporation in the work whether or not incorporated in the work.

.2 Remove rejected products and work from the premises immediately.

.3 Replace rejected products and work with no delay after rejection. Provide replacement products and execute replacement work precisely as required by the Specifications for the defective work replaced. Previous inspection and payment shall not relieve the Contractor from the obligation of providing sound and satisfactory work in compliance with the Specifications.

.4 Testing and retesting of any part of the work as directed by the FMAA Project Manager, Consultant or Contractor to establish its conformance to the Contract Documents shall be performed at no addition to the Contract Price.

1.9 WORKERS, SUPPLIERS AND SUBCONTRACTORS

.1 Assign work only to workers, suppliers, and Subcontractors who have complete knowledge, not only of the conditions of the Specifications, but of jurisdictional requirements, and reference standards and specifications.

.2 Give preference to use of local workers, suppliers and Subcontractors wherever possible.

.3 Certified and qualified installers of a specific product line shall be used when called for in these Specifications.

1.10 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

2.1 SPECIFIED PRODUCTS

.1 Products used for temporary facilities may have been previously used, providing they are sound in structural qualities.

.2 Specified Options: The Work is based on materials, Products and systems specified by manufacturer's catalogued trade names, references to standards, by prescriptive specifications and by performance specifications. Where the Plans and Specifications list two or more products or two or more manufacturers of the same product, the Contractor may select one of the listed products or manufacturers. Contractor shall confirm selection of products and manufacturers when requested by the FMAA.

.1 For the purpose of these specifications, the term "Acceptable Products" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name or any combination thereof.

.2 When only one product or manufacturer is listed in the Plans and Specifications, it is intended that only that product or manufacturer is acceptable.

.3 Where materials are specified by reference standards, Contractor shall select any material that meets or exceeds the specified standard.

.4 Where materials are required to be listed on the Canadian General Standards Board Qualified Products List, Contractor shall select any manufacturer so listed.

.5 Where materials are specified by performance description, Contractor shall select any material meeting or exceeding specification.

.6 When materials are specified by a Standard, performance or prescriptive specification, Contractor shall obtain an independent testing laboratory report from the manufacturer showing that the subject material or product meets or exceeds the specification.

.3 Products, materials, equipment and articles (referred to as Products throughout the Contract Documents) incorporated in the Work shall be new, not damaged or defective, and of the quality standards specified, for the purpose intended. If requested, furnish evidence as to type, source and quality of Products Provided.

.4 Where Contract Documents list acceptable Products or acceptable manufacturers, select as applicable, any one Product from any one manufacturer meeting performance of specifications.

.5 Where Contract Documents require design of a Product or system, and minimum material requirements are specified, the design of such Product or system shall employ materials specified within applicable section. Where secondary materials or components are not specified, augment with materials meeting applicable code limitations, and incorporating compatibility criteria with adjacent work.

.6 Defective Products, whenever identified prior to completion of the Work, will be rejected, regardless of previous reviews. Review of the Work by the Consultant or inspection and testing companies does not relieve the Contractor of the responsibility for executing the Work in accordance with the requirements of the Contract Documents, but is a precaution against oversight or error. Remove and replace defective Products and be responsible for delays and expenses caused by rejection at no additional cost to the FMAA.

.7 Should any dispute arise as to quality or fitness of Products, the decision rests strictly with Consultant based upon the requirements of the Contract Documents.

.8 Unless otherwise indicated in the Contract Documents, maintain uniformity of manufacturer for any like item, material, equipment or assembly for the duration of the Work.

.9 Products exposed in the finished work shall be uniform in colour, texture, range, and quality, and be from one production run or batch, unless otherwise indicated.

.10 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical, electrical, machinery or like rooms.

.11 FMAA retains right to select from choices available within specified Products for colours, patterns, finishes or other options normally made available. Submit full range of Product options in accordance with 01 33 00 for such selection.

.12 Quality Control:

.1 Implement a system of quality control to ensure compliance with Contract Documents.

.2 Notify Consultant of defects in the Work or departures from intent of Contract Documents that may occur during construction. Consultant will recommend appropriate corrective action in accordance with requirements of the Contract.

.13 Substitution:

.1 No substitutions of material, products, or equipment will be permitted without the written approval of the FMAA.

.2 Proposals for substitution may only be submitted after the award of Contract and only for one or more of the following reasons:

.1 Insolvency of the product manufacturer or material supplier.

.2 Inability of the manufacturer to provide the product(s) in the timeframe required to maintain the construction schedule.

.3 Product specified is no longer available.

.4 Substitution proposed offers better performance than that specified, at no additional cost.

.5 Substitution offers equivalent performance to that specified, at a reduced cost to the FMAA (reduction in Contract Price).

.3 Submit and provide a signed letter from the manufacturer, confirming their inability to provide the specified products to meet the construction schedule, stating the reasons.

.4 Propose substitution be accepted either in part or in whole, the Contractor shall assume full responsibility for performance and for the cost when the substitution affects other work in the Contract. Contractor shall also pay for design and drawing changes necessitated by the substitution.

.5 Amounts of all credits arising from approval of substitutions will be determined by FMAA and Contract Price will be reduced accordingly.

2.2 CONSTRUCTION PLANT AND EQUIPMENT

.1 If requested, provide evidence satisfactory to the FMAA that plant and equipment are adequate to manufacture, transport, place and finish Work to quality, safety and performance standards called for. If found to be inadequate, replace with appropriate plant and equipment.

2.3 METRIC MATERIALS

.1 SI metric units of measurement are used exclusively on drawings and in the Plans and Specifications for this Work.

.2 Provide metric products in same size called for in the Contract Documents except where a valid claim can be made that a particular product is not available in the Canadian market in metric dimensions.

.3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supporting documentation. Submit application to FMAA for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the FMAA.

.4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market, will not be considered sufficient reason for claiming that they cannot be provided.

.5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in the Contract Documents, install or erect Products in accordance with manufacturer's printed instructions. Do not rely on labels or enclosures supplied with Products. Obtain printed instructions directly from manufacturers.

.2 Notify FMAA in writing, of conflicts between the Contract Documents and manufacturer's instructions. Allow enough time for FMAA to establish a course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no additional cost to the FMAA.

.4 Manufacturers' representatives shall have access to the Work at all times. Contractor shall render assistance and facilities for such access in order that the manufacturers' representatives may properly perform their function.

3.2 GALVANIC/DISSIMILAR METAL CORROSION

.1 Insulate dissimilar metals from each other by suitable plastic strips, washers or sleeves to prevent galvanic corrosion where conductive liquid or electrolyte exists.

3.3 WORKMANSHIP

.1 Execute the Work using workers experienced and skilled in the respective duties for which they are employed.

.2 Ensure quality of Work is of the highest standard, executed by workers experienced and skilled in the respective duties for which they are employed. FMAA reserves the right to require dismissal from the site, workers deemed to be incompetent, unqualified, or careless in the performance of their portion of the Work.

.3 In cases of dispute the FMAA's decision will be final as to the standard or fitness of the quality of work.

.4 Do not employ an unfit person or anyone unskilled in their required duties.

.5 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with Consultant, whose decision is final.

.6 Upon request by the Consultant, submit proof, in the form of CCDC 11 - Contractor's Qualification Statement, of qualifications of Subcontractors to verify Subcontractor's qualifications and experience meet or exceed the requirements of the Contract Documents.

.1 If, upon review of the Contractor's Qualification Statement, it is found that the Subcontractor does not meet the qualification requirements specified in the Contract Documents pertaining to the parts of the Work for which the Subcontractor has been retained, the Contractor shall replace the unqualified Subcontractor with a qualified Subcontractor, satisfactory to the Contractor and the FMAA Project Manager, at no additional cost to FMAA and at no increase in the Contract Time.

.2 Coordination:

.1 Ensure cooperation of workers in layout of the Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

.3 Cutting and Remedial Work:

.1 Perform cutting and remedial work required to make parts of the Work come together. Coordinate the Work to ensure this requirement is maintained. Obtain permission from Consultant before commencing any cutting.

.4 Fastenings:

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action and corrosion between dissimilar metals and materials.

.3 Use non-corrosive hot dipped galvanized steel fasteners and anchors for securing exterior work. Use stainless steel or other non-ferrous material specifically called for in a particular Section.

.4 Space anchors within individual load limit or shear capacity. Ensure permanent anchorage is provided. Do not use wood or other organic plugs.

.5 Keep fastenings concealed at all locations. If exposed fastenings is used, space evenly and install neatly.

.6 Fastenings cause spalling or cracking of material are not acceptable. Replace of spalled or cracked finish material.

.7 Obtain FMAA approval before using explosive-actuated fastening devices and comply with CSA-Z166.

.8 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.9 Use heavy hexagon heads, semi-finished, unless otherwise specified. Use No. 304 stainless steel for exterior locations

.10 No projection of bolts more than one diameter beyond nuts.

.11 Use plain type washers on equipment, sheet metal, etc. and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

.5 Protection of work in progress:

.1 Take reasonable and necessary measures, including those required by authorities having jurisdiction, to Provide protection.

.2 Adequately protect parts of the Work completed or in progress. Parts of the Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no additional cost to FMAA.

.3 Do not cut, drill or sleeve any load bearing structural member without written permission of Consultant, unless specifically indicated.

.4 Keep floors free of oils, grease or other materials likely to discolour them or affect bond of applied surfaces.

.5 Protect work of other Subcontractors from damage while doing subsequent work. Damaged work shall be made good by appropriate Subcontractors but at expense of those causing damage.

.6 Protect existing buildings, curbs, roads and lanes. If, during the Work, any buildings, curbs, roads or lanes are damaged, bear costs for repairs.

.6 Existing Utilities:

.1 When breaking into or connecting to existing services or utilities, execute the Work at times approved by FMAA Project Manager, with a minimum of disturbance to FMAA's ongoing operations, the Work, and traffic.

.2 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by authority having jurisdiction and stake or otherwise record location of capped service.

.7 Operational requirements: Operable Products shall be Provided fully operational and ready for intended use.

END OF SECTION

1 General

1.1 EXAMINATION

.1 Acceptance of Conditions:

.1 Examine all existing or pre-determined conditions, prior to commencing Work in that area, and report to the FMAA all conditions unacceptable for work to proceed. Commencement of work shall imply acceptance of conditions as is.

.2 Ensure subcontractors examine all existing or pre-determined conditions affecting their portion of the Work, prior to commencing such work, and provide report to list out conditions unacceptable for work to proceed. Commencement of Work shall imply acceptance of conditions as is.

1.2 PREPARATION

.1 Field Engineering

.1 Locate, confirm and protect control points prior to starting the Work and preserve permanent reference points during construction.

.2 Establish reference lines and elevations, locate and lay out by qualified surveyor and with help of proper instrumentation.

.2 Surveyor Qualifications

.1 Certified land surveys for the FMAA must be prepared by a Registered Alberta Land Surveyor (ALSA member) acceptable to the FMAA.

.3 Survey Reference Points

.1 Survey control networks both horizontal and vertical have been established at Fort McMurray International Airport. The Airport is an integrated survey area, and all surveys carried out on, or for the site, shall be integrated to the afore mentioned survey control networks.

.2 Existing base horizontal and vertical control points shall be referenced on drawings.

.3 Contractor shall locate, confirm and protect control points prior to starting Work. Contractor shall preserve permanent monuments and reference points during time of construction.

.4 Contractor shall report to FMAA Engineer when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Contractor shall make no changes to control points without prior written permission of the FMAA.

.6 Contractor shall require surveyor to replace control points in accordance with original survey control.

.4 Survey Requirements

.1 Contractor shall establish lines and levels, locate and lay-out by instrumentation, use Differential Global Positioning System (DGPS) tied to survey control networks.

.2 Contractor shall assume full responsibility for and execute lay-out of work to locations, lines and elevations indicated.

.3 Contractor shall provide devices required to control the location and fabrication of the work, such as lines, stakes, survey markers and levels.

.4 Contractor shall inform the FMAA for clarification if a discrepancy arises in given control points.

.5 Contractor shall establish temporary bench marks and reference same to control points both horizontal and vertical, and record information in the Project Record Documents.

.6 Contractor's work also includes, staking for finished grades, fill and topsoil placement, staking slopes embankments and berms, establishing invert elevations for pipe inlets and outlets in manholes, establishing building grid and establishing lines and levels for mechanical, electrical and other service work.

.5 Records

.1 Maintain and retain a complete and accurate log of control and survey work as it progresses.

.2 On completion of major site improvements, building outline, roads and other features, prepare a certified survey showing dimensions, locations, angles and elevations. Contractor shall provide three dimensional co-ordinates of all major components.

.3 Record location of all maintained, re-routed and abandoned service lines.

1.3 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of mechanical and electrical equipment, fixtures and devices indicated or specified, are to be considered as approximate. Final location of such items will be determined on site, based on integration with structural and architectural elements, and as required by coordination with other trades. In the event of a conflict, final determination of location of these items rests with the FMAA.

.2 Contractor shall prepare and submit for review by the FMAA, interference field drawings, to indicate relative position of various services and equipment, at the following locations as a minimum:

.1 At locations of all major ductwork, piping, and conduit crossovers.

.2 Where ductwork passes under major structural elements.

.3 Contractor shall locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.4 Contractor shall request a review of items by FMAA once rough-in is underway, prior to final installation, and obtain approval for actual locations.

1.4 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of the Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work using specialists expert with the materials affected and by avoiding damage to, or putting at risk, adjacent portions of the Work.

.3 Execute Work with least possible interference or disturbance to occupants, public and normal use of premises. Contractor shall arrange with FMAA to facilitate execution of Work.

1.5 PROTECTION OF WORK IN PROGRESS

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the FMAA, at no increase in Contract Price.

.2 Prevent overloading of any part of the building. Contractor shall do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of the FMAA.

.3 Protect finished surfaces with overlays of protective materials such as Kraft paper, cardboard, plastic sheets, plywood, or other materials as required to suit the site and as required for individual applications to provide adequate protection.

.4 All protection measures must be approved by the FMAA.

1.6 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 DESCRIPTION OF WORK

.1 Follow a strategy based on the 3R's hierarchy:

.1 **Reduce** the generation of waste materials.

.2 **Reuse** waste materials on-site and/or Salvage waste materials for use in other construction projects.

.3 **Recycle** waste materials back into manufacturing processes.

.2 Conduct a Waste Audit (WA): The Contractor shall assess the amount, type and composition of the waste generated by the performance of the Work in accordance with the requirements of these Plans and Specifications.

.3 Prepare a Waste Reduction Workplan ("WRW"): The Contractor shall identify opportunities to reduce, reuse, and recycle waste in accordance with the requirements of these Plans and Specifications.

.4 Implement a Material Source Separation Program ("MSSP"). The Contractor shall separate materials at the point of generation in accordance with the requirements of these Plans and Specifications.

.5 Provide Waste Tracking Reports ("WTR's"): The Contractor shall summarize the solid waste generated by the performance of the Work, the waste quantities diverted from landfill and the means by which the diversions were achieved. The Contractor shall clearly indicate the percentage of total solid waste materials diverted from landfill.

1.2 REFERENCES

.1 Alberta Environmental Protection and Enhancement Act.

.2 Alberta Ministry of Environment and Protected Areas.

.3 Canadian Construction Association. Standard Construction Document CCA 27-1997: A Guide on Construction Environmental Management Planning.

.4 Canadian Construction Association. Standard Construction Document CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.

.5 Canada. Public Works and Government Services Canada. 2002 National Construction Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

1.3 WASTE MANAGMENT DOCUMENTS

.1 Waste Audit ("WA") – Schedule A

.1 Conduct a WA prior to start of construction Work .

.2 Follow Canadian Construction Association's "best practices" for conducting a waste audit in Standard Construction Document CCA 81-2001.

.3 List and itemize waste by specification division number, material and material category.

.4 For each waste material item, the Contractor shall:

.1 Provide projections for the amounts generated, reused (on-site), salvaged (off-site), recycled and sent to landfill (by weight or volume)

.2 For salvaged, recycled and landfill materials, list the receiving facility.

.5 Submit the WA report thirty (30) days prior to start of construction Work to the FMAA for review.

.6 Update the WA report regularly thirty (30) day maximum revision delay to reflect the most recent information available as the Work progresses.

.2 Waste Reduction Workplan ("WRW") – Schedule B

.1 Base on information acquired from the WA.

.2 Prepare a WRW prior to start of construction Work.

.3 Follow the Canadian Construction Association's "best practices" for preparing a waste reduction workplan in Standard Construction Document CCA 81-2001.

.4 Include the following measures in the WRW to reduce waste:

.1 Request suppliers to minimize packaging of construction materials;

.2 Invite suppliers to retrieve/retain packaging after delivery (for reuse);

.3 Order materials in accurate quantities to minimize surplus;

.4 Prevent damage of materials due to:

.1 Mishandling;

.2 Improper storage;

.3 Contamination;

.4 Inadequate protection; and

.5 Other factors;

.5 Use prefabricated assemblies built at a central facility when possible to avoid waste generation at the site;

.6 Plan installations to use materials efficiently by minimizing cutting and/or other modifications that generate waste; and

.7 Measure and cut accurately.

.5 Include the following measures in the WRW to divert inevitable waste from landfill:

.1 Reuse materials on-site when possible

.2 Salvage materials for use in other construction projects

.3 Recycle materials back into manufacturing processes (refer to Material Source Separation Plan)

.6 Submit the WRW report twenty (20) days prior to start of construction Work to the FMAA for review.

.7 Prior to start of construction Work, obtain approval from the FMAA to proceed with the measures in the WRW.

.3 Material Source Separation Program ("MSSP") – Schedule C

.1 Prepare the MSSP and have the MSSP in place prior to start of construction Work.

.2 Follow Canadian Construction Association's "best practices" for preparing a Material Source Separation Program in Standard Construction Document CCA 81-2001.

.3 Separate waste materials that can be reused on-site from other waste materials and store with construction materials.

.4 Based on the results of the WA and WRW, develop a list of materials to be reused, salvaged, or recycled, which shall include the materials listed in Schedule C.

.5 Contact local salvaging/recycling facilities and arrange for services, provided that only facilities operating under a certificate of approval as required by the Environmental Protection and Enhancement Act shall be considered.

.6 Provide on-site facilities for the collection, handling, and storage of the anticipated quantities of source-separated wastes:

.1 Follow the material acceptance requirements of the salvaging/recycling facilities so that materials are properly sorted, grouped, packaged, bundled and shipped.

.2 Provide suitable containers for the collection of waste that are properly sized and made from materials that can adequately contain the waste.

.3 Provide an adequate number of containers and locate containers to facilitate the deposit of materials without hindering daily operations.

.4 Provide separate containers for each of the following material categories (and for additional materials as required by the salvaging/recycling facilities):

.1 Portland cement concrete / masonry / stone;

.2 Cardboard;

.3 gypsum (e.g. drywall);

.4 steel and other metals;

.5 wood;

.6 land clearing debris; and

.7 asphalt.

.5 Provide separate containers for “blue box” waste (generated by site workers) collected in a mixed condition that will be separated for recycling off-site. The waste deposited in this container shall include:

.1 aluminium food or beverage cans;

.2 glass bottles and jars for food or beverage;

.3 PET bottles for food or beverages; and

.4 steel food or beverage cans.

.6 Provide a separate container for remaining mixed waste that will be transported to a facility for separation and recycling.

.7 Mark clearly all containers with signs indicating what materials are allowed to be deposited.

.8 Protect materials from damage and contamination.

.7 Transport source-separate materials from the site and deliver same to approved facilities for salvaging or recycling.

.8 Submit to the FMAA upon request waybills, invoices, and other documentation confirming that all materials have been transported to the required locations.

.9 Submit the MSSP report twenty (10) days prior to start of construction Work to the FMAA for review.

.10 Prior to start of construction Work, obtain approval from the FMAA to proceed with the measures in the MSSP report.

.4 Waste Tracking Reports (WTR) – Schedule D

.1 Record waste shipments using WTR.

.2 Prepare regular (thirty (30) day maximum revision delay) reports summarizing the status of the performance of the Work.

.3 Ensure that the WTR shall contain the following for each waste material category item shown in the most recent version of the WA:

.1 The amounts generated, salvaged, recycled and sent to landfill; and

.2 The receiving facility and tipping fees/credits.

.5 Documentation and Records:

.1 Maintain one complete, up-to-date copy of each of the required documents at the job site.

.2 Provide up-to-date copies of the WA, WRW, MSSP, and WTR documents to all Subcontractors working on-site.

.3 Post up-to-date copies of the WA, WRW, MSSP, and WTR documents in a location that is easily accessible for review by all site workers.

.4 Submit a final report to the FMAA containing the final versions of the following:

.1 Waste Audit (WA);

.2 Waste Reduction Workplan (WRW);

.3 Material Source Separation Program (MSSP); and

.4 Waste Tracking Reports (WTR's)

1.4 GENERAL – CLEANING AND WASTE MANAGEMENT

.1 Comply with Applicable Laws (including the Environmental Protection and Enhancement Act and regulations therefor) relating to construction waste management.

.2 Conduct work of this section in accordance with general requirements of the contract.

.3 Conduct cleaning and disposal operations to comply with local ordinances and environmental protection legislation.

.4 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.

.5 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.6 Minimize the amount of waste generated by construction Work, renovation, and demolition activities.

1.5 WASTE MANAGEMENT COORDINATOR ("WMC"):

.1 Designate an individual to be responsible for all aspects of construction waste management. The WMC shall be regularly on-site (preferably full-time) during the performance of construction Work. The Contractor shall ensure that individuals designated by each Subcontractor are responsible for waste management related to their trade and for coordinating activities with the WMC (provide that the Contractor shall remain fully responsible to the FMAA for waste management notwithstanding such designation by the Subcontractors).

1.6 PRE-CONSTRUCTION CLEANING COORDINATION

.1 After approval of the WRW and MSSP and prior to the start of construction Work, conduct a pre-construction meeting and present the Construction Waste Management Program to all Subcontractors.

.2 Describe and promote the Waste Management Objectives and the Code of Practice.

.3 Communicate the requirements of these Plans and Specifications to all Subcontractors and introduce the WMC.

.4 Train Subcontractors about proper recycling protocol.

.5 Scheduling: Coordinate the Work with other activities at site to ensure timely and orderly progress of the Work

1.7 CLEANING DURING CONSTRUCTION

.1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the FMAA or other Contractors.

.2 Remove waste material and debris from the work areas and off Airport property. Deposit in waste container at the end of each working day.

.3 Do not burn or dump waste materials on Airport property and subject to severe penalty.

.4 Individual Subcontractors are responsible for the daily clean-up and removal of debris related to, or generated by, their own work. The overall responsibility for project cleanliness rests with the Contractor.

.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Provide on-site containers with lockable tight covers for collection of waste materials and debris. Contractor shall locate where approved by FMAA and comply with requirements of Section 01 57 00.

.7 Clean concealed areas prior to start of finish Work and maintain areas free of dust and other contaminants during finishing operations.

.8 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.8 WASTE MANAGEMENT

.1 Audit, separate and dispose of construction waste generated by new construction or by demolition of existing structures in whole or in part, in accordance with local laws and ordinances in place of Work.

.2 Fires, and burning of rubbish or waste on site is prohibited.

.3 Burying of rubbish or waste materials, except as specified herein, is prohibited.

.4 Disposal of waste or volatile materials such as mineral spirits, oil, gasoline or paint thinner into ground, waterways, or sewer systems is prohibited.

.5 Empty waste containers on a regular basis to prevent contamination of site and adjacent properties by wind-blown dust or debris.

1.9 FINAL CLEANING OPERATIONS

.1 Immediately following Date of Substantial Performance, and prior to FMAA occupancy of the building or portion of the building affected by the Work, conduct full and complete final cleaning operations.

.2 Final cleaning operations shall be performed by an experienced professional cleaning company, possessing equipment and personnel sufficient to perform full building cleaning operations.

.3 Remove all surplus products, tools, construction machinery and equipment not required for the performance of remaining work, and thereafter remove any remaining materials, equipment, waste and debris.

.4 Remove all waste and sweep all surfaces clean of dust and other extraneous materials.

.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.7 Cleaning operations shall include the removal of all stains, spots, scuff marks, dirt, dust, remaining labels, adhesives or other surface imperfections.

.8 Broom clean and spray wash all exterior paved surfaces.

.9 Remove dirt and other disfiguration from exterior surfaces.

.10 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

1.10 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 This section identifies the minimum testing requirements of the FMAA at the close-out phase of the Work, prior to issuance of a certificate of acceptance. A summarized list of the testing and inspection items required is as follows:

.1 Functionality / operability of the tank system and components including and not limited to pumps, valves, pipe weld and leak tests, panels, alarms.

1.2 REFERENCES

.1 FMAA Testing, Commissioning, Acceptance and Turnover Manual.

1.3 DEFINITIONS

.1 “Close-out Testing”: Contractor's process of testing, balancing and adjusting of equipment and systems to verify their function and operation in accordance with the requirements of the Contract, prior to application for Substantial Performance of the Work.

1.4 GENERAL GUIDELINES

.1 The Work shall be the sole responsibility and be under the care, custody and control of the Contractor until the Construction Control Office has issued a Certificate of Acceptance.

.2 The Contractor acknowledges that, before any Persons may occupy a building or part thereof, certain elements and life safety systems as defined in the latest version of 2023 Airport Construction Code v8.0 must be tested, verified and fully operational.

.3 The Contractor shall be solely responsible for arranging testing, scheduling, shutdowns, security and fire watch necessary for official demonstrations.

.4 The Contractor and its Subcontractors shall supply all measurement devices and testing equipment as may be necessary.

.5 Testing shall be performed by the Contractor as required by applicable codes and standards, the Construction Control Office and their designates, and the FMAA.

.6 All signals from FMAA monitored facilities shall register and record with the FMAA Airport Operations Control Centre (“AOCC”). The Contractor shall have a fire alarm technician present at the AOCC to acknowledge all testing related trouble and alarm signals.

.7 All testing of life safety systems shall be co-ordinated by the Contractor through the Maintenance Dispatch Centre (“MDC”), with a minimum of seventy-two (72) hours’ notice from the Contractor prior to the actual testing.

.8 Within buildings or facilities other than Terminals, testing shall be arranged so as to be conducted during normal working hours.

1.5 CLOSE-OUT TESTING AND ACCEPTANCE PROCESS

.1 The Contractor acknowledges that the FMAA close-out testing and acceptance process has a number of stages that the Contractor shall complete in their entirety to the satisfaction of the FMAA and other applicable Authorities Having Jurisdiction. These stages are as follows:

.1 Contractor and Subcontractors close-out testing prior to application for Substantial Performance of the Work,

.2 FMAA demonstrations,

.3 Deficiency corrections,

.4 Substantial Performance of the Work application,

.5 Demonstration to the FMAA and other Authorities Having Jurisdiction (Parts A & B of all applicable items),

.6 FMAA Training.

1.6 TESTS AND INSPECTION ITEMS

.1 Refer to individual technical section for additional requirements

.2 Civil, Mechanical and Electrical Systems; (including all related sections)

.1 **Part A:** Required inspection and testing

.1 Inspect and show completed in accordance with the Contract at various stages of the performance of the Work in order to achieve Substantial Performance of the Work.

.2 **Part B:** Submit following documents to the CCO upon the successful completion (include submission date for each):

.1 Letters of assurance confirming construction compliance with NBC, Airport Construction Code and all other applicable codes and standards from prime Consultant and all major sub-consultants.

.2 Verification certificates.

1.7 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 GENERAL INSTRUCTIONS

.1 The procedures for completing Contract and acceptance by the FMAA Project Manager shall be in accordance with the methods prescribed by FMAA.

.2 Stages will be reviewed at the Contract start-up meeting to ensure that parties understand their responsibilities. Refer to Section 01 31 19 – Project Meetings for procedures and requirements for Contract start-up meeting.

.3 Within four (4) weeks of commencement of the Work, submit to the Consultant a list of closeout submittals required by the Contract Documents.

.4 Note that entities other than the FMAA Project Manager may be involved in the closeout procedures described herein, including attendance at any operation and/or maintenance training sessions required. The FMAA Project Manager will coordinate such attendance as required.

1.2 FINAL CLEANING

.1 Refer to Section 01 74 00 – Cleaning and Waste Processing.

1.3 CLOSE-OUT SUBMITTALS

.1 Refer to requirement in Section 01 78 00 – Closeout Submittals.

.2 Collect reviewed submittals, and assemble required closeout submittals executed by Subcontractors, Suppliers, and manufacturers. Prior to submitting closeout submittals to the Consultant, undertake the following:

.1 Review maintenance manual contents (operating, maintenance instructions, as built drawings, materials) for completeness.

.2 Review in relation to Contract Price, Change Orders, Change Directives, holdbacks and other adjustments to the Contract Price.

.3 Review inspection and testing reports to verify conformance to intent of Contract Documents and that changes, repairs or replacements have been completed.

.4 Execute transition of performance bond and labour and materials payment bond to warranty period requirements.

.5 Submit a final statement of accounting giving total adjusted Contract Price, previous payments, and monies remaining at time of application for completion of the Contract. Consultant will issue a final change order reflecting approved adjustments to Contract Price not previously made, if any.

.3 No later than then (10) working days prior to submitting request for Consultant's review to determine if Substantial Performance of the Work has been achieved, submit to the Consultant the closeout submittals specified in this section, including, but not limited to, reviewed shop drawings, Product data sheets, samples, operating instructions, as-built records, and fully executed warranties and guarantees.

.4 For items of the Work delayed materially beyond date of Substantial Performance of the Work, provide updated closeout submittals within ten (10) working days after acceptance, listing date of acceptance as start of warranty period.

.5 Neither the Consultant's review to determine if Substantial Performance of the Work has been achieved, nor acceptance of the Work, will take place until receipt, by the Consultant, of acceptable copies of the closeout submittals required herein and by the Contract Documents.

.6 As-built records and operation and maintenance manuals, as indicated in Section 01 33 00 – Submittal Procedures.

.7 Maintenance materials:

.1 Deliver to a location and at a time specified by the FMAA Project Manager, organize items in designated storage area as directed by the FMAA Project Manager, and as follows:

.1 Use unbroken cartons, or if not supplied in cartons, material shall be strongly packaged.

.2 Clearly mark cartons or packaging as to contents, project name, and Supplier.

.3 If applicable give colour and finish, room number or area where material is used.

.2 Replace incorrect or damaged maintenance materials delivered to FMAA, including damage through shipment.

.3 Provide a typed inventory list of maintenance materials prior to Substantial Performance of the Work application. List all items, complete with quantities, and storage locations.

.4 Establish a master list identifying maintenance materials and maintain a log of when materials are turned over to FMAA and signing authority for acceptance of materials on behalf of FMAA. Master list and log shall be in a format acceptable to the FMAA Project Manager.

.8 FMAA communication material:

.1 Deliver FMAA communication material that was applied to hoarding and/or temporary barriers and enclosures during the Work. Salvage such material in accordance with Section 01 11 00 – Summary of Work.

1.4 INSPECTION AND DECLARATION

.1 Contractor's Inspection: The Contractor (including under the Contractor's direction any and all subcontractors) shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract documents.

.1 Notify the FMAA Engineer, in writing, of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request the FMAA Engineer's Inspection.

.2 FMAA Engineer's Inspection: The FMAA Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly. Inspection by the FMAA Engineer does not relieve the Contractor from responsibility for other defects or deficiencies which are not reported during the inspection.

.3 Completion: The Contractor shall submit written certificate stating that the following has been performed;

.1 Work has been completed and inspected for compliance with Contract documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Boiler Inspection Branch, Fire Commissioner, utility companies have been submitted.

.5 Operation of systems have been demonstrated to FMAA's personnel.

.6 Work is complete and ready for final inspection.

.4 Final Inspection: When items noted above are completed, the Contractor shall request final inspection of Work by the FMAA Engineer and Contractor. If Work is deemed incomplete by the FMAA Engineer, the Contractor shall complete outstanding items and request re-inspection. In

cases where the work is deemed to be incomplete it shall be at the FMAA's discretion to charge for the cost for the FMAA Engineer's time and the cost of any Consultant representing FMAA to perform the inspection and apply that cost against monies owed under the Contract.

.5 Declaration of Substantial Performance: When the FMAA Engineer considers deficiencies and defects to have been corrected and submission of documents as specified in Section 01 78 00 - Closeout Submittals is completed and compliance with requirements of Contract have been substantially performed, the Contractor shall make application for certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: The Contractor shall note that the date of FMAA's acceptance of submitted declaration of Substantial Performance shall be the date for commencement of warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Payment of Holdback: After issuance of certificate of Substantial Performance of Work and forty-five (45) days after providing certificate of publication, the Contractor shall submit an application for payment of holdback amount.

.8 Final Payment: When the FMAA Engineer considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, the Contractor shall make application for final payment. If Work is deemed incomplete by the FMAA Engineer, the Contractor shall complete outstanding items and request re-inspection.

1.5 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 In addition to the requirements of the Construction Lien Act for Substantial Performance of the Work, the following shall be completed in all respects to the satisfaction of the FMAA:

.1 Work has been completed and has been reviewed for compliance with the Contract,

.2 Defects have been corrected and deficiencies have been completed,

.3 Equipment and systems have been set up, adjusted, balanced, tested and are fully operational,

.4 Equipment and systems have been demonstrated to be in full, correct and functional operation to appropriate FMAA personnel,

.5 Certificates from agencies and Authorities Having Jurisdiction have been obtained and submitted,

.6 As-built documentation has been submitted and reviewed for completeness and accepted as completed by the FMAA,

.7 Schedules of maintenance Materials, spare parts and special tools have been submitted and verified by the FMAA.

.2 Final Inspection for completion of the Contract:

.1 Made good to deficiencies and defects before the Contractor submits a written request for final review of the Work and before the Contract is considered complete.

.2 When Contractor is satisfied that the Work is complete, and after the Contractor has reviewed the Work to verify its completion in accordance with the requirements of the Contract Documents, the Contractor shall submit a written request for a final review by the Consultant, who in turn will notify the FMAA Project Manager.

.3 If there are any deficiencies identified as a result of this review, they shall be listed by the Consultant and submitted to the Contractor. This list shall be recognized as the final deficiency list for purposes of acceptance of the Work under the Contract.

.4 Such deficiencies shall be corrected by a date mutually agreed upon between Consultant and the Contractor, unless a specific date is required by Contract, and a further review by

the Consultant shall be called for by the Contractor following his own review to take place within seven (7) days from date of request.

.5 Contractor shall thereafter submit invoice for final payment.

.6 Money shall be withheld for deficiency work and will be released only when all deficiencies have been completed. No partial payment to be recognized until all work is completed.

.3 If the Contractor needs to return to the Place of the Work to complete deficiencies after the FMAA Project Manager has taken possession, the Contractor shall provide the FMAA Project Manager with a minimum of one (1) week's prior notice of such requirement.

.4 If the FMAA, after review of the Work, is in agreement with the Contractor's application for Substantial Performance of the Work, the FMAA shall draft a certificate for Substantial Performance of the Work and submit it to the FMAA for final approval.

.5 The FMAA shall, if it agrees with the certificate submitted by the Contractor, issue the Certificate for Substantial Performance of the Work.

.6 The Contractor shall publish a copy of the certificate once in a construction trade newspaper (Daily Commercial News) within seven (7) days, in accordance with the Construction Lien Act, and shall forward a copy of the certification of date of publication to both the FMAA and the Engineer.

.7 The day following the publication date of the certificate for Substantial Performance of the Work shall be the first day of the forty-five (45) day lien period in accordance with the Prompt Payment and Construction Lien Act of Alberta.

1.6 WARRANTY PERIOD

.1 Provide on-going review and attendance to call-back, maintenance and repair problems during the warranty periods.

.2 At the beginning of the 12th month after Substantial Performance of the Work, the FMAA Project Manager, Contractor and Consultant, along with key Subcontractors as designated, shall carry out a complete review of the built project to determine which deficiencies are to be rectified under the warranty.

.3 Contractor shall be responsible for timely written notification of FMAA Project Manager, and Consultant a minimum of three (3) months prior to such end of warranty period inspection and any delay in such notification shall extend such warranty period until proper notification is received by FMAA Project Manager, and Consultant.

1.7 ACCEPTANCE TESTING AND TURNOVER PROCESS

.1 The FMAA acceptance testing process has a number of stages that the Contractor must complete in their entirety to the satisfaction of the FMAA and other applicable Authorities Having Jurisdiction (AHJ). These stages are as follows:

.1 Contractor's and Subcontractor's testing prior to Substantial Performance of the Work,

.2 FMAA and AHJ demonstrations,

.3 Deficiency corrections,

.4 Substantial Performance of the Work application,

.5 FMAA acceptance testing,

.6 FMAA demonstration and training,

.7 Final acceptance and turnover.

1.8 FINAL COMPLETION

.1 At the conclusion of the forty-five (45) day lien period, the Contractor shall submit an application to the FMAA for release of the basic holdback amount.

.2 If no liens, applications for liens or other monetary claims exist, and the FMAA, after review of the Work, is in agreement with the Contractor's application, the FMAA shall issue a certificate for payment for release of the basic holdback amount, subject to retention by FMAA of funds for as-built documentation that has not yet been submitted, as provided for in Section 01 78 00 Close Out Submittals.

.3 When the Contractor determines that all outstanding unfinished Work has been completed and all outstanding efficiencies have been corrected, the Contractor shall submit an application to the FMAA for Total Performance of the Work. If the FMAA, after review of the Work, is in agreement with the Contractor's application, the FMAA shall issue a final certificate for payment for release of any outstanding monies, subject to retention by FMAA of funds for as-built documentation that has not yet been submitted, as provided for in Section 01 78 00 Close Out Submittals.

1.9 MEASUREMENT PROCEDURES

.1 Payment of Holdback: After issuance of certificate of Substantial Performance of Work and forty-five (45) days after providing certificate of publication, the Contractor shall submit an application for payment of holdback amount.

.2 Final Payment: When the FMAA Engineer considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, the Contractor shall make application for final payment. If Work is deemed incomplete by the FMAA Engineer, the Contractor shall complete outstanding items and request re-inspection.

.3 No additional payment will be made for the requirements under this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SUBMISSION

.1 Prepare instructions, drawings and data using personnel experienced in maintenance and operation of described products.

.2 Revise content of documents as required prior to final submittal.

.3 Pay costs of shipping.

.1 As-Built Documents: To Consultant's business address.

.2 Spare Parts, Maintenance Materials, and Special Tools: To site.

1.2 AS-BUILT DOCUMENTS

.1 Obtain from the Consultant and pay cost for one copy of Specifications and one set of white prints of the Contract Drawings at the commencement of Work, and, prior to the date of Substantial Performance, an extra set of white prints of Contract Drawings, for as-built purposes.

.2 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.3 As Work progresses, clearly mark in a neat and legible form with red pen on Specifications and drawing white prints all significant changes and deviations from the Contract Drawings and Specifications caused by site conditions, Supplemental Instructions and Change Orders.

.1 Changes and deviations marked on as-built record drawings and specifications by reference to Supplemental Instructions, Change Orders and other documents are not acceptable.

.4 Record the following changes and deviations on drawing white prints:

.1 3D-coordinates of all structures, facilities and utilities,

.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction,

.3 Depths of various elements of foundation in relationship to the grade level.

.4 Field changes of dimensions.

.5 Changes made by Addenda and change orders.

.6 References to related shop drawings and modifications.

.7 Details not on original Contract Drawings.

.8 Other significant deviations and changes which are concealed in construction and cannot be identified by visual inspection.

.9 Include drawings and schedules produced by Subcontractors used on site for actual installation purposes.

.5 Show actual locations of the following on drawing white prints:

.1 Measured horizontal and vertical locations of site utilities and appurtenances, referenced to permanent surface improvements.

.2 Ductwork, piping, conduit, mechanical and electrical equipment and associated work.

.3 Concealed piping, conduit and equipment, including such items provided for future use.

.6 Record the following information on the Specifications.

.1 Manufacturer, trade name, and catalogue number of each product actually installed particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.3 Accepted substitutions and alternatives.

.4 Other approved changes and deviations to items specified.

.7 Have white prints and specifications available for review at all times.

.8 Final As-Built Drawings: Prior to the date of Substantial Performance, allowing for Consultant's review, clearly, neatly and accurately transfer information from the marked-up drawing white prints to a set of clean white prints.

.1 Prepare as-built drawings in accordance with the FMAA CADD Standard Guide.

.2 Print lettering and numbers in size to match original.

.3 Lines may be drawn free hand, provided they are neat and accurate. Add "AS-BUILT RECORD" at each drawing title block. Should extensive changes and deviations to a drawing make the information illegible, re-draft the changed areas as required.

.4 Submit drawing white prints made containing as-built record information for Consultant's review. Correct as directed by Consultant.

.9 Submit finalized as-built record drawing transparencies and as-built record specifications to the FMAA Project Manager and Consultant two weeks prior to application for Certificate of Substantial Performance:

.1 Revise the content of documents as noted prior to final submittal.

.2 Make final submittal of amended documents to the FMAA as follows:

.1 Drawings (including shop drawings): One (1) digital copy (scanned CAD+PDF file).

.2 Specifications: One (1) digital copy (PDF or native file in Word).

.3 Failure by the Contractor to deliver complete as-built documentation to the FMAA shall result in the retention by the FMAA of 10% of the total final value of the Work until such documentation is delivered.

1.3 OPERATING AND MAINTENANCE MANUAL

.1 Six weeks prior to application for Certificate of Substantial Performance of the Work, submit to the Consultant, one (1) hard copy and one (1) digital copy of operating and maintenance manuals in English.

.2 Hard Copy:

.1 Binders: vinyl, hard covered, 3 D-ring, loose leaf 219 mm x 279 mm (8-1/2"x 11") with spine and face pockets.

.2 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.3 Digital Copy:

.1 Store in USB drive, in PDF searchable format.

.2 Organize digital manual in the same arrangement as hard copy manual.

.4 Organize data in the form of an instructional manual.

.5 Arrange content by systems or process flow, as directed, under Section numbers and sequence of Table of Contents.

.1 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.2 Provide bookmark for digital PDF manual.

.6 The text shall be manufacturer's printed data, or typewritten data.

.7 Cover: Identify each binder with type or printed title; list title of project and identify subject matter of contents:

.1 Operations & Maintenance Manual

.2 Volume 1 of __

.3 <<Contents of Binder>>

.4 <<FMAA Project Title>>

.5 <<FMAA Project or Contract Number>>

.6 Fort McMurray Airports Authority

.7 Date of submission.

.8 Names and full contact information for all consultants, Contractors and Subcontractors (including suppliers) with name of responsible parties

.8 Manual Content: Including but not limited to the following:

.1 Table of contents for that volume.

.2 Schedule of products and systems.

.3 For each product and/or system the Contractor shall list full contact information for Subcontractors, including local source of supplies and replacement parts.

.4 Product Data: The Contractor shall mark each sheet to clearly identify specific products and component parts, and data applicable to installation and delete inapplicable information.

.5 Drawings: The Contractor shall supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.6 The Contractor shall provide typewritten text as required to supplement product data. The Contractor shall provide a logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 40 00 - Quality Requirements.

.7 Other Documents: The Contractor shall provide manufacturer's certifications, warranties, inspection certifications, field test records and reports as required by the Plans and Specifications.

.8 Materials and Finishes

.1 General: The Contractor shall include product data, with catalogue number, size, composition, and colour and texture designations. The Contractor shall provide information for re-ordering custom manufactured products.

.2 The Contractor shall provide instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: The Contractor shall include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements shall be provided as specified in individual Plans and Specifications sections.

.9 Warranties, Guarantees, and Bonds

.1 The Contractor shall separate each warranty, guarantee or bond with index tab sheets keyed to Table of Contents listing.

.2 The Contractor shall list Subcontractors, suppliers, and manufacturers, with name, address, and telephone number of responsible principal.

.3 The Contractor shall obtain warranties and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of Work.

.4 Except for items put into use with FMAA's permission, the date of commencement of warranties shall be the Date of Substantial Performance of the Work.

.5 The Contractor shall verify that documents are in proper form, contain full information, and are notarized.

.6 The Contractor shall co-execute submittals when required.

.7 The Contractor shall retain warranties, guarantees and bonds until the time specified for submittal.

1.4 FINAL SURVEY & CERTIFICATE

.1 Fourteen (14) days prior to anticipated date of Substantial Performance of the Work, the Contractor shall submit the final site survey to the FMAA for review and comment.

.2 The Contractor shall revise content as noted prior to final submittal.

.3 The Contractor shall make a final submittal of amended document to the FMAA as follows:

.1 One digital copy (CAD/MicroStation files) of site survey.

.4 The Contractor shall submit the final site survey certificate, certifying that elevations and locations of completed Work are in conformance, or non-conformance with the Contract.

1.5 STORE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.6 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work.

.4 Except for items put into use with FMAA Project Manager's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

1.7 MEASUREMENT PROCEDURES

.1 No additional payment will be made for the requirements of this section and the cost thereof will be deemed to have been included in the Contract Price.

.2 The payment of holdback will only be made after the receipt and approval of all completed documentation, as-built drawings, spare parts, etc., in accordance with the specified requirements of this Section, and as directed, and after 45 days of the issuance of the Substantial Performance of Work of Certificate of Publication, whichever is latest, and subject to the provisions of the Prompt Payment and Construction Lien Act.

2 Products

2.1 MATERIALS

.1 Provide new spare parts, maintenance materials and special tools, undamaged or defective, and of same quality and manufacture as products provided in the Work.

.2 Defective products will be rejected, regardless of previous inspections. Replace products at no expense to the FMAA.

.3 If requested, furnish evidence as to type, source and quality of products provided.

2.2 SPARE PARTS, MAINTENANCE MATERIALS AND SPECIAL TOOLS

.1 Provide spare parts, maintenance and extra materials in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing of all spare parts, maintenance materials and special tools in digital Microsoft word or excel format to Consultant. Include approved listings in Operating and Maintenance Manuals.

.5 Obtain receipt for delivered products and submit prior to final payment.

.6 Spare Parts:

.1 Provide spare parts in quantities for a minimum of 2 years of operation and maintenance and as recommended by the manufacturers, unless otherwise specified in individual Plans and Specifications sections or as directed.

.2 Submit spare parts list with quantities to the FMAA for its approval prior to purchase and delivery to the site.

.7 Maintenance Materials:

.1 Provide maintenance and extra Materials, in quantities specified in individual Plans and Specifications sections.

.2 Finish materials incorporating colour and/or pattern shall be from the same dye lot or production run as those products supplied to the Work. If requested, the Contractor shall furnish evidence as to source and quality of the Work provided.

.8 Special Tools:

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

2.3 EQUIPMENT AND SYSTEMS

.1 Include descriptions of unit or system and component parts for each item of equipment and each system. Provide function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Maintenance Requirements: Include routine procedures and guide for trouble-shooting, disassembly, repair, and reassembly instructions, and alignment, adjusting, balancing, and checking instructions.

.3 Operating Procedures:

.1 Include start-up, break-in, and routine normal operating instructions and sequences.

.2 Include regulation, control, stopping, shut-down, and emergency instructions.

.3 Include summer, winter, and any special operating instructions.

.4 Panel Board Circuit Directories: Provide electrical service characteristics, controls, and communications.

.5 Provide single line diagrams, indicate breaker and cable sizes and indicate source of supply. Provide short circuit and coordination studies. Indicate fuse sizes and relay settings.

.6 Provide installed colour-coded wiring & piping diagrams.

.7 Provide installed control diagrams and sequence of operation by controls manufacturer.

.8 Provide servicing and lubrication schedule, and list of lubricants required.

.9 Include manufacturer's printed operation and maintenance instructions.

.10 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance. Including list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage for 2-years operation and maintenance.

.11 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.12 Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.

.13 Additional Requirements: Provide all additional requirements as may be specified in individual Plans and Specifications sections.

3 Execution

3.1 TAKEOVER PROCEDURES

.1 Conform to OAA/OGCA Document No.100 for takeover procedures, subject to amendments by this Section.

.2 Contractor's Inspection: Contractor shall conduct an inspection of the Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.3 Request for Substantial Performance Inspection: Notify Consultant in writing of satisfactory completion of Contractor's inspection and that corrections have been made and request Consultant's inspection.

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by the authorities having jurisdiction and utility companies have been submitted.

.5 Operation of systems have been demonstrated to FMAA Project Manager and required personnel.

.6 Work is complete and ready for Substantial Performance inspection.

.4 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.5 When Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been performed, make application for certificate of Substantial Performance.

.1 Submit a statement of accounting giving total adjusted Contract Price, previous payments, and monies remaining due.

.2 Consultant will issue a final change order reflecting approved adjustments to Contract Price not previously made.

.6 Application for Release of Holdback: After issuance of Certificate of Substantial Performance of Work, submit an application for payment of holdback amount. Submit a statement of accounting giving holdback monies due under lien legislations.

3.2 SUBMITTAL SCHEDULE

.1 The Contractor shall provide the following summary of approved submittal items required upon completion of the Work and the required format for submission to the FMAA. The more detailed set of requirements is set forth in the FMAA engineering checklists.

Submittal Item	Final Submittal Format
As-Built Drawings (General)	
As-Built Drawings (Shop Drawings, Contractor's Mark-ups)	CAD and PDF
As-Built Specifications	PDF or native Word
Subcontractors' Installation Drawings	AutoCAD
Operations & Maintenance Manuals (General)	
Inventory of Spare Parts, Maintenance Materials, and Special Tools	Word or Excel
Warranties & Bonds	PDF
Shop Drawings	CAD and PDF
Mechanical	
Colour Coded Piping Diagrams	PDF and CAD
Valve Tag Schedules	Excel
Lubrication Schedules	Excel
Electrical	
Coordination Study	
Panel Schedules	Excel
Colour Coded Wiring Diagrams	PDF and CAD

Submittal Item	Final Submittal Format
Maximo (RMax) Data	Excel
Fire Alarm & Monitoring Systems (If applicable)	
System Plan Layout Drawings Notes and Details	
System Schematic Drawings: • Network schematics, • Individual Panel (DGP/MXL) drawings & schematics, • System Interface Schematics (baggage system, security doors, fan shutdown, stair pressurization, lighting system, public address system, smoke evacuation system, etc.).	
System Zone Drawings	
System Verification and Inspection Reports	
System Certification Documents	
Manufacturers' Equipment Data Sheets	
Sprinkler, Standpipe & Fire Pump Systems (If applicable)	
System Plan Layout Drawings Notes and Details	
System Schematic Drawings	
System Zone Drawings	
Contractor's Materials & Test Certificates	
System Hydraulic Calculations	
Certified Fire Pump Flow Curves	
Site Testing Fire Pump Discharge Curves	
Manufacturers' Equipment Data Sheets	
Other Systems and Equipment Data	
Fire Extinguishers Location Size and Type	
Emergency Power Systems & Equipment	
Emergency Lighting Systems & Equipment	
Fixed Extinguishing Systems	

END OF SECTION

1 General

1.1 WARRANTIES

.1 Warranties shall be in accordance with the General Conditions, as amended, and as follows:

.1 Warranties shall commence at date of Substantial Performance of the Work.

.2 Submit warranties for applicable items, signed by the applicable company responsible for each warranty.

.3 Submit warranties on form approved by FMAA Project Manager including, but not limited to, the following information:

.1 Name and address of Project.

.2 Warranty commencement date (date of Substantial Performance of the Work).

.3 Duration of warranty.

.4 Clear indication of what is being warranted and what remedial action will be taken under warranty.

.5 Authorized signature and seal of company providing each warranty.

.4 Coordinate with FMAA representative for the correct name to place in manufacturer's Product warranties. Use FMAA provided name. Submit on relevant Product manufacturer's standard warranty or guarantee form.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Demonstration and Training: the process of demonstrating the operation, control and functionality of equipment and systems to appropriate FMAA personnel for verification purposes, and the subsequent training of FMAA Operations and/or Maintenance personnel in their use and care. Successful completion will result in the issuance of FMAA issuing a certificate of acceptance.

1.2 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to FMAA Project Manager and personnel four weeks prior to date of Substantial Performance.

.2 FMAA Project Manager will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

.3 The contractor shall include for qty. (1) demonstration session of 4 hour duration at site.

1.3 QUALITY ASSURANCE

.1 Instructor Qualifications: Factory authorized service representative, experienced in operation and maintenance procedures and training.

.2 Pre-Instruction Meeting: Conduct meeting at Project site to review methods and procedures related to demonstration and training including, but not limited to, the following:

.1 Inspect and discuss locations and other facilities required for instruction.

.2 Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.

.3 Review required content of instruction.

.4 For instruction that must occur outdoors, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 SUBMITTALS

.1 Instruction Program: Submit three copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

.1 At completion of training, submit three complete training manuals for FMAA and FMAA's personnel use.

.2 Attendance Record: For each training module, submit list of participants and length of instruction time.

1.5 COORDINATION

.1 Coordinate training schedule with FMAA facilities' operations. Adjust schedule as required to minimize disrupting FMAA’s operations.

.2 Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

.3 Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Consultant.

1.6 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into satisfactory operation.

.2 Testing, adjusting, balancing and commissioning have been performed and equipment and systems are fully operational.

2 Products

2.1 GENERAL GUIDELINES

.1 The Work shall be the sole responsibility and under the care, custody and control of the Contractor until the Construction Compliance Office has issued a certificate of acceptance.

.2 Before any Persons may occupy a building or part thereof which comprises a portion of the Work, certain elements and life safety systems; must be tested, verified and shown to be fully operational by the Contractor to the satisfaction of the FMAA.

.3 The responsibility for arranging and scheduling systems demonstrations rests solely with the Contractor. The Contractor is responsible to engage the services of all sub-trades and equipment vendors to participate with the demonstrations.

.4 Demonstrations shall be performed by the Contractor as required by the Construction Compliance & Permits Office or its designate and the FMAA Fire Prevention Office.

.5 All signals from FMAA - monitored facilities must register with and record to the FMAA Integrated Operations Control Centre (“IOCC”). The Contractor shall have a fire alarm technician present at the IOCC to acknowledge all trouble and alarm signals.

.6 All life safety systems demonstrations shall be coordinated through the Maintenance Dispatch Centre (“MDC”), with a minimum of seventy-two (72) hours’ notice prior to each demonstration.

.7 The Contractor acknowledges that, within occupied buildings that are monitored by the IOCC, any system demonstration is dependent on the extent of any operational impact, and shall be scheduled for off-periods (for example: 23:00 to 05:00) hours unless otherwise agreed by the FMAA in writing.

.8 Within other buildings or facilities, demonstrations may with the FMAA’s approval be arranged to be conducted during normal working hours.

2.2 INSTRUCTION PROGRAM

.1 Program Structure: Develop an instruction program that includes individual training modules for all systems and equipment not part of a system, including and not limited to:

.1 Motorized doors.

.2 Electrically operated equipment.

.3 Fire-protection systems.

.4 Security systems.

.5 Heat generation.

.6 Refrigeration systems.

.7 HVAC systems.

.8 HVAC instrumentation and controls.

.9 Electrical service and distribution.

.10 Packaged engine generators.

.11 Lighting equipment and controls.

.12 Communication systems.

.2 Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following, as applicable:

.1 Operational Requirements and Criteria:

.1 System, subsystem, and equipment descriptions.

.2 Performance and design criteria if Contractor is delegated design responsibility.

.3 Operating standards.

.4 Regulatory requirements.

.5 Equipment function.

.6 Operating characteristics.

.7 Limiting conditions.

.8 Performance curves.

.2 Emergencies:

.1 Instructions on meaning of warnings, trouble indications, and error messages.

.2 Instructions on stopping.

.3 Shutdown instructions for each type of emergency.

.3 Operations:

.1 Startup procedures.

.2 Equipment or system break-in procedures.

.3 Routine and normal operating instructions.

.4 Operating instructions for conditions outside of normal operating limits.

.5 Regulation and control procedures.

.6 Control sequences.

.7 Safety procedures.

.8 Normal shutdown instructions.

.9 Operating procedures for system, subsystem, or equipment failure.

.10 Seasonal and weekend operating instructions.

.11 Required sequences for electric or electronic systems.

.4 Adjustments:

.1 Alignments.

.2 Checking adjustments.

.3 Noise and vibration adjustments.

.4 Economy and efficiency adjustments.

.5 Troubleshooting:

.1 Diagnostic instructions.

.2 Test and inspection procedures.

.6 Maintenance:

.1 Inspection procedures.

.2 Types of cleaning agents to be used and methods of cleaning.

.3 List of cleaning agents and methods of cleaning detrimental to product.

.4 Procedures for preventive maintenance.

.5 Procedures for routine maintenance.

.6 Instruction on use of special tools.

.7 Repairs:

.1 Diagnosis instructions.

.2 Repair instructions.

.3 Disassembly; component removal, repair, and replacement; and reassembly instructions.

.4 Instructions for identifying parts and components.

.5 Review of spare parts needed for operation and maintenance.

3 Execution

3.1 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

3.2 DEMONSTRATION AND TRAINING

.1 Delivery demonstration and training of each item of equipment at scheduled times, at the designated location.

.2 Instruct FMAA Project Manager and personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Review contents of manual in detail to explain all aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

3.3 EVALUATION AND CLEANUP

.1 Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

.2 Cleanup: Collect used and leftover educational materials and give to FMAA Project Manager and personnel. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

1 General

1.1 SUMMARY

.1 General requirements for the Contractor to provide services for commissioning facilities and facility systems.

1.2 QUALITY CONTROL

.1 Unless otherwise specified or directed, the Contractor shall comply with the FMAA Testing, Commissioning, Acceptance and Turnover Manual which is available upon request from the FMAA Engineer.

1.3 COMMISSIONED SYSTEMS

.1 Mechanical (if applicable):

- .1 Air Cooled Units (RTU/CRAC)
- .2 Gas Detection System - including but not limited to H2, NOx, CO
- .3 Humidifier/Dehumidifier
- .4 Unit Heaters (Gas & Electric, Ceiling & Wall)
- .5 Circulation Fans (Permanently Installed HVLS, Patterson, other) – Review strobe effect from light fixtures.
- .6 Exhaust Fans – Restroom & Building
- .7 VRF/VRV systems
- .8 Energy Recovery Units
- .9 VAVs
- .10 Air Curtains
- .11 Indoor Air Quality Devices (CO2, RH, T)
- .12 Ductless Split Systems
- .13 Dedicated MDF HVAC System
- .14 Condensate Pumps
- .15 Heat Sensor Installation –CBRE & Safety/IT Sensors
- .16 Sequence of Operations for each system
- .17 Building Management System
  - .1 All required systems are being monitored by CBRE.
  - .2 Proper set points.
  - .3 Verification Point to Point testing and Programming has been completed by others.
  - .4 Verify system is communicating with offsite monitoring.
- .18 Review of TAB reports completed by others (EOR to perform as well)
- .19 Guard house and all applicable systems

.2 Plumbing:

- .1 Hot Water System

.1 Recirculating Pumps

.2 Thermostatic Mixing Valves

.3 Hot Water Heater

.4 Boiler

.5 Expansion Tanks

.2 Plumbing Fixtures (Proper water temperatures, installed and supported properly, ADA fixture accessibility, drainage, sensors, functionality, and leaks)

.1 Sinks/Faucets (Test function of several running faucets at one time for general water flow and drainage.)

.2 Showers (If required by AHJ)

.3 Ablution

.4 Toilets/Urinals (Confirm sanitary system can handle flushing of several toilets at one time.)

.5 Eye Wash Station

.3 Sump/Lift Station Pumps.

.4 Booster Pumps – Domestic & Reclaimed.

.5 Water Softeners.

.6 Water Hammer Arrestors.

.7 Meters – Gas and Water.

.8 Sewer/Grinder Pumps.

.9 Pressure Reducing Valves.

.10 Backflow Preventers.

.11 Shut-Off Valves - Clearly located, labeled, locations noted on posted map and as-builts.

.12 Roof Drains – Insulated and protected, as necessary.

.13 Clean-outs – Proper location and quantity.

.14 Trap Primers.

.15 Scrubber Dump.

.1 Proper location of water spigot

.2 Proper location of GFCI outlet with waterproof enclosure for scrubber charging

.3 Oil/Water Separators

.16 Witness imaging of all underground sanitary and storm piping. (At mobilization on existing/MR as well.)

.17 Appliance & Water Cooler Connections

.3 Electrical (if applicable):

.1 Power Generation/Generators including Load Bank Tests.

.2 Transfer Switches – ATS or MTS.

.3 UPS/PDU/EPO/MDP.

.4 Lighting and Lighting Control Systems – including interior and exterior lighting, daylight, occupancy, time-of-day, and zone controls – verification of lighting levels – emergency lighting(inverter) testing – exit signs – Smoke/Transportation Shelters.

.5 Ground Fault Protection System.

.6 Panelboards.

.7 Switchboards.

.8 Transformers.

.9 Electrical Meter.

.10 Power Monitoring - including mains and sub-panels.

.11 Surge Protection Devices

.12 GFCI Outlets/Breakers

.13 Busways

.14 Arc Flash Coordination Study, Power Cable & Electrical Connection Torque Testing – Cx review only scope completed by electrician.

.15 IT Communication Strength of Wired and Wireless Network…Verification and review of Wireless scan completed by others (Airopath).

.16 Local UPS systems for MDF and Demarc Equipment.

.17 Labeling.

.18 Restroom Andon Lights.

.19 Illuminated Signage.

.20 Lightning Protection.

.21 Solar (if owned by Owner).

.22 Electrical and Propane Vehicle Systems.

.4 Fire Suppression System (if applicable):

.1 Fire Suppression Systems - Tests to be completed by subcontractor and verified by AHJ. Cx to confirm completion and review of documentation only.

.1 Piping, Valves, Drains.

.2 Fire & Jockey Pumps.

.3 Diesel Fuel Tank (Verify Permitting).

.4 Dry Systems - Nitrogen Generator/Compressor.

.5 Preaction Systems.

.6 Annunciator Panel – Location Coordinated with fire department.

.7 Confirm fire alarm valve schedule is posted.

.8 Confirm all NFPA 13 tests have been completed.

.2 Fire Alarm Systems - Tests to be completed by subcontractor and verified by AHJ. Cx to confirm completion and review of documentation only.

.1 Review required forms of communication by AHJ (Cellular, Cellular and POTS, Radio, Etc.)

.2 Fire Alarm monitoring is enabled and properly calling to offsite monitoring location.

.3 Fire Alarm system properly functioning with building BAS system, MHE and building doors/security.

.4 Review NFPA 72 & Installation Verification Reports

.3 Smoke Removal Systems

.5 General (if applicable):

.1 Structural Improvements for Natural Disaster Preparedness

.2 Security - including auto operator integration, egress locks, turn stiles and door locks.

.3 Vertical Transport Systems/Elevator

.4 Roof

.1 BTS & Spec - Review Roof Manufacturer and Consultant (If Applicable) Reports

.2 Existing - Confirm remaining warranty and life expectancy within report.

.3 Witness flood test if applicable

.5 Fire Extinguishers installed and properly labeled.

.6 Dock Equipment – Leveler, lock, light, fan, green/red light, signage, disconnect.

.7 Review and Confirm Construction Project Checklist (Precon/CM Checklist) has been completed and note exceptions.

.8 High Speed Roll-Up & Coiling Doors.

.9 Verification all way finding signage is installed and arrows properly indicate direction of travel.

.10 Adequate MEPF Protection from Equipment, Vehicles and Carts. Including bollards and sensor/thermostat cages as necessary

.11 Fall Protection – Roof Ladder & Roof Units/Perimeter/Openings

.12 Storm System

.1 Oil/Water Separators

.2 Camera to confirm clear from obstructions and proper slope/flow. Including review of water detention systems. To be completed to AHJ connection points.

.13 Exterior Envelope Review

.1 Witness storefront/curtain wall water test if applicable

.2 Façade and Roof Thermal Imaging (Provide Add Alternate)

.14 Review of O&M Manuals and As-builts for General Conformance to Standards

.1 Emphasis to be placed on verification of EV infrastructure As-builts.

.2 Filming of On-site Training (Provide Add Alternate).

.15 Irrigation – Timers, Functionality and Zone Controls.

.16 Air Monitoring of Office Area – CO2, CO, VOC, and Dust Particulate Levels.

1.4 SUBMITTALS

.1 Prior to start of Work, submit name of organization proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting, operating and commissioning.

.1 Submit documentation to confirm organization compliance with quality assurance provision.

.2 Submit 3 preliminary specimen copies of each report form proposed for use.

.3 Two weeks prior to Substantial Performance, submit 3 copies of final reports on applicable forms.

.4 Submit reports of testing, adjusting, and commissioning postponed due to reasons beyond Contractor's control, promptly after execution of those services.

1.5 PROCEDURES - GENERAL

.1 Comply with procedural standards of certifying association under whose standard services will be performed.

.2 Notify the FMAA Engineer seven (7) Calendar Days prior to beginning of operations.

.3 Record data accurately for each step.

.4 Report to the FMAA Engineer any deficiencies or defects noted during performance of services.

.5 Cooperate with the FMAA independent commissioning agent or commissioning authority, as applicable.

1.6 FINAL REPORTS

.1 Have an organization having managerial responsibility to prepare the reports.

.2 Ensure each form bears signature of recorder and that of supervisor of reporting organization.

.3 Identify each instrument used, including its latest date of calibration.

1.7 CONTRACTOR RESPONSIBILITIES

.1 Testing and commissioning including provision of equipment, tools and materials, as required, is to be carried out at Contractor's own cost.

.2 Prepare each system for testing, adjusting, operating and commissioning.

.3 Cooperate with testing organization and provide access to equipment and systems.

.4 Provide personnel and operate systems at designated times, and under conditions required for proper adjusting, testing and commissioning.

.5 Notify testing organization seven (7) Calendar Days prior to time project will be ready for testing, adjusting, operating and commissioning.

1.8 PREPARATION

.1 Provide instruments required for testing, adjusting, operating and commissioning operations.

.2 Make instruments available for the FMAA Engineer to facilitate spot checks during testing.

.3 Retain possession of instruments and remove at completion of services.

.4 Verify systems installation is complete and in continuous operation.

1.9 MEASUREMENT PROCEDURES

.1 No additional payment will be made for requirements under this section and the cost thereof will be deemed to have been included in the Contract Price.

2 Products

Not Used

3 Execution

Not Used

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, and services and perform all operations required to complete concrete formwork and falsework installation.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 03 20 00 – Concrete Reinforcing

.3 Section 03 30 00 – Cast-in-Place Concrete

1.3 REFERENCES STANDARDS

.1 Canadian Standards Association (CSA):

.1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA O86-19, Engineering Design in Wood

.3 CSA O121, Douglas Fir Plywood.

.4 CSA O151, Canadian Softwood Plywood.

.5 CSA O153-M, Poplar Plywood.

.6 CSA O325, Construction Sheathing.

.7 CSA O437, Standards for OSB and Waferboard.

.8 CSA S136, Cold-formed steel structural members.

.9 CSA S269.1, Falsework for Construction Purposes.

.10 CAN/CSA-S269.3-M, Concrete Formwork.

.11 CSA-S413, Parking Structures

.2 American Concrete Institute (ACI):

.1 ACI 347, Guide to Formwork of Concrete.

.3 National Lumber Grades Authority (NLGA):

.1 Standard Grading Rules for Canadian Lumber, 2010.

1.4 DEFINITION

.1 Architectural Concrete — Concrete that is exposed as an interior or exterior surface in the completed structure that contributes to the visual character of the completed structure.

1.5 DESIGN REQUIREMENTS

.1 Design formwork in accordance with CSA S269.1, CAN/CSA S269.3-M and CSA A23.1 Clause 6.5 – Formwork. For Architectural Concrete, provide formwork that conforms to the requirements of CSA A23.1 Clause 8.3.4 – Formwork for Special Architectural Finishes.

.2 Design and engineer falsework and formwork including shoring and bracing to resist loads due to wet concrete, forms, wind, dead loads, construction live loads, and forces arising from the use of equipment to place concrete without a differential settlement between them and to ensure finished concrete within the tolerances required by CSA-A23.1/A23.2.

.3 Design forms for concrete exposed to view or to carry finish, with a maximum deflection of 1/400th of span.

.4 When a high range water reducer (superplasticizer) is used in concrete mix, design forms for full hydrostatic pressure.

.5 Make joints in forms watertight.

.6 Design formwork to meet variations from a reference system specified in CSA A23.1 Clause 6.4.6.

1.6 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Indicate the method and schedule of construction, shoring, stripping, and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and comply with CAN/CSA S269.3-M for formwork drawings.

.3 Shop drawings shall indicate:

.1 Layout of panel joints, and tie hole pattern.

.2 Method of sealing form tie hole.

.3 Coordinate with details where shown on the Contract Drawings.

.4 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequences of erection and removal of formwork/falsework.

.6 Include full details and locations of splices.

.7 Each shop drawing submission shall be stamped and signed by a qualified professional engineer licensed to practice in the Province of Alberta.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release, and stripping agents that are non-toxic, biodegradable, and have zero or low VOCs.

2 Products

2.1 MATERIALS

.1 For concrete with special architectural features, use formwork materials in accordance with CSA A23.1/A23.2.

.2 Structural steel: CAN/CSA-G40.21-M; Grade 300W and Grade 350W

.3 Welding Materials: CSA W48 and CSA W59.

.4 Plywood: CSA O121, G1S; Douglas Fir plywood, sheets as large as practical, minimum 19 mm thick, seven-ply, exterior grade, waterproof glue, edges sealed with an oil-based sealer.

.5 Prefabricated steel forms: CSA S136; Free of irregularities, dents, sags, rust, and materials that can discolor the concrete finish.

.6 Steel forms: seamless, steel plates, internally treated with release material.

.7 Tubular column forms: Round, spirally wound laminated fiber forms free of dents and other irregularities, complete with seamless plastic liner, internally treated with a form release agent.

.8 Form ties:

.1 For concrete not designated 'Architectural Concrete', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in the concrete surface.

.2 For Architectural Concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.3 Wire ties shall not be permitted.

.9 Form release agent: Quick-drying, sprayable, non-staining, non-toxic coating, compatible with paint and mortar, VOC compliant, containing compounds that react with free lime present in concrete forming water-insoluble soaps, preventing concrete from sticking to forms.

.1 Eucoslip VOX by The Euclid Chemical Company.

.2 Clean Strip Ultra (J-3 VOC) by Dayton Superior Corp.

.3 Sealtight Duogard II by W.R. Meadows of Canada Ltd.

.4 Debond Form Coating by L&M Construction Chemicals Inc. Buffalo., N.Y.

.10 Chamfer strips: 20 x 20 mm triangular fillets milled from clear, straight grain pine, surfaced on each side, or extruded vinyl type, with or without nailing flange.

.11 Falsework materials: in accordance with CSA S269.1.

.12 Sealant: in accordance with Section 07 92 00 – Sealants.

3 Execution

3.1 FABRICATION AND ERECTION

.1 Unless specified otherwise in the Contract Documents, follow the applicable recommendations of CSA S269.1 and S269.3-M.

.2 Obtain approval from the Consultant for the use of earth forms framing openings not indicated on the Drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Do not place shores and mud sills on frozen ground.

.5 Provide Site drainage to prevent the washout of soil supporting mud sills and shores.

.6 Align form joints and make them watertight. Keep form joints to a minimum.

.7 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, and joints, unless specified otherwise in the Contract Documents.

.8 Construct forms for Architectural Concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.9 Build-in anchors, sleeves, and other inserts are required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.10 Do not re-use damaged formwork which may not provide a uniform, consistent finish.

.11 Prior to the closing of forms and placement of concrete, notify the Consultant for field inspection review.

.12 Clean formwork in accordance with CSA-A23.1/ A23.2, before placing concrete.

3.2 TOLERANCES

.1 Variations from plumb: In 3000mm 6mm

.2 In any storey of 6000mm, maximum 8mm

.3 Variation from the level in tops of floor slabs: In 3000mm 6mm

.4 For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines: In any bay 6mm

.5 Variation in size of walls and floor openings: +13mm

.6 Variation in cross-sectional dimensions:

.1 Variation in plan dimensions: -6mm +12mm

.2 Slabs and walls: -3mm +6mm

.7 Footings and Caps:

.1 Variation in plan dimensions: -0

.8 Variation in steps:

.1 Rise: +/- 3mm

.2 Tread: +/- 6mm

3.3 SHORING AND BRACING

.1 Provide bracing to ensure the stability of the formwork as a whole. Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.

.2 Provide a positive means for adjustment of shores and struts and to take up the settlement of formwork during the placing of concrete.

3.4 REMOVAL AND RE-SHORING

.1 Leave formwork in place for the following minimum periods after placing concrete.

.1 4 Days for walls.

.2 7 Days for columns and gradebeams.

.2 Provide all necessary re-shoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.3 Strip formwork in accordance with CSA A23.1 and CSA S269.1

.4 Ensure the safety of the structure, both before and after the removal of forms until concrete has reached its specified compressive strength. Employ methods and sequences of removal of formwork and falsework to permit concrete to gradually take up the stresses involved.

.5 Space re-shoring in each principal direction at not more than 3,000 mm apart.

.6 Re-shoring shall remain until the concrete has reached its 28-Day designed compressive strength.

.7 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.5 CONSTRUCTION JOINTS

.1 Obtain approval from the Consultant for location and details of construction joints shown a minimum of two weeks prior to start formwork.

3.6 EXPANSION AND CONTROL JOINTS

.1 Construct expansion and control joints at the locations indicated and in accordance with the details shown on the Contract Drawings.

.2 Construct clean expansion joints free of foreign material, likely to impair the proper operation of the joint.

.3 Provide a non-extruding joint filler in expansion joints for the full area between adjacent concrete members. Anchor the filler material to one of the adjacent members or between concrete members and adjacent members of other materials.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete reinforcing installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Formwork and Falsework

.2 Section 03 30 00 – Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):

.1 CSA A23.1:19/A23.2:19, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

.2 CAN/CSA A23.3:19, Design of Concrete Structures.

.3 CSA A23.4-16, Precast Concrete - Materials and Construction

.4 CAN/CSA G30.18-M, Billet Steel Bars for Concrete Reinforcement.

.5 CSA S413, Parking Structures.

.6 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA W186-M, Welding of Reinforcing Bars in Reinforced Concrete Construction

.2 Alberta Provincial Standard Specification:

.1 Construction Specification for Steel Reinforcement for Concrete.

.2 OPSS.Prov 1440, Steel Reinforcement for Concrete

.3 Construction Safety Act or any other regulations of the Alberta Ministry of Labour relating to the work of this section.

.4 ASTM International:

.1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, For Concrete.

.5 Reinforcing Steel Institute of Canada (RSIC):

.1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.4 QUALITY ASSURANCE

.1 Welder Qualifications: CSA W47.1 and CSA W186 certified.

1.5 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Submit to the Consultant, at least 20 working days before placing any concrete, reinforcing bar placement drawings prepared in accordance with the Reinforcement Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and as specified below.

.2 Submit reinforcement drawings prepared in accordance with the RSIC Manual of Standard Practice.

.3 Design and detail lap lengths to CAN/CSA A23.3:19. Supply Class B splices unless shown otherwise on the Contract Drawings. Splices are to be staggered unless otherwise shown on the Contract Drawings.

.4 If the bar list and bending schedule contain details of bars of more than one reinforcing bar placement drawing, then arrange bar marks in separate groups for each placement drawing. Clearly indicate for each bar mark the corresponding reinforcing bar placement drawing number.

.5 For slabs, show a separate plan indicating concrete thickness, reinforcing bars, and dowels for walls and columns cast in the slab.

.6 For walls, show separate elevations indicating concrete thicknesses, reinforcing bars, and dowels for slabs and adjacent wall cast-in walls.

.7 Show the position and size of openings in slabs and walls. Cooperate with trades requiring openings to ascertain necessary information.

.8 Do not add new information on previously reviewed shop drawings.

.9 Reinforcing bar placement shop drawings will be reviewed for bar sizes, locations, and spacing.

.10 Submit shop drawings of dowel bar splicers, detailing locations, sizes, and types.

.11 Substitution of different size bars may be permitted upon written acceptance of the Consultant.

.12 Reproduction of the Contract Drawings for use as shop drawings is not permitted.

.13 The Consultant reserves the right to relocate reinforcing prior to and during the approval of placing diagrams for the purpose of clearing openings for ducts, piping, wall inserts, etc., and to finalize the location of mechanical and electrical opening, etc. at no additional cost to the Owner. Any cost involved in revisions to placing diagrams or bar lists as a result of these changes shall be borne by the Contractor.

.14 The Consultant’s review of shop drawings will not relieve the Contractor from his responsibility for ensuring that his work is complete, accurate, and in accordance with the drawings and specifications.

.3 Product Data Sheets:

.1 Submit to the Consultant, at least 20 working days before placing any concrete, three samples, and three copies of the manufacturer's product data sheets including installation and maintenance instructions for:

.2 Submit the manufacturer's Product data sheets including installation and maintenance instructions for chairs, bolsters, bar supports, and side form spacers, dowel bar splicers, and mechanical splices.

.4 Test Reports:

.1 Submit certified copies of mill test reports for reinforcing steel, showing physical and chemical analysis, a minimum of 30 Days prior to commencing the Work. Determine physical and chemical properties of steel reinforcing in accordance with requirements of CSA-G30.18.

.5 Certificates:

.1 Submit welding certificate in accordance with CSA W47.1 and CSA W186-M.

.6 Information Submittals:

.1 Submit in writing the proposed source of reinforcement material to be supplied.

.2 Dowel Bar Splicers:

.1 Verification that device threads have been tested and meet the requirements for thread quality, in accordance with the manufacturer's published methods.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 – Material and Equipment and with the manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to the Site in original factory packaging, labeled with the manufacturer's name and address.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. Indicate the mill run for which bars were fabricated.

.4 Storage and Handling Requirements:

.1 Store reinforcing steel off the ground and kept free of mud, dirt, oil, and any contaminants that may adversely affect the performance of reinforcing steel. Comply with CSA A23.1:19/A23.2:19.

.2 Deteriorated or contaminated materials will be rejected and shall be removed from the site.

.3 Replace defective or damaged materials with new materials at no additional cost to the Owner.

2 Products

2.1 MATERIALS

.1 Substitution of different size bars may be permitted upon written acceptance of the Consultant.

.2 Reinforcing Bars:

.1 Reinforcing steel: CAN/CSA G30.18-M; Carbon-steel bars, deformed unless indicated otherwise in the Contract Documents, Grade 400R.

.2 Weldable reinforcing steel: CAN/CSA-G30.18-M; Weldable low alloy steel bars, where welding of reinforcing bars is indicated in the Contract Documents, deformed, Grade 400W.

.3 Plain round reinforcing steel: CAN/CSA G30.18-M; round, Grade 400R, for expansion joints.

.4 Do not substitute with epoxy-coated bars.

.3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M, minimum 1.6 mm diameter, with coating for use with uncoated and coated reinforcing steel.

.4 Bar Supports and Spacers:

.1 Adequate for accurate placing and as required for construction loads.

.2 Provide non-conductive bar supports in contact with exposed surfaces that have geometry and bond characteristics that prevent moisture movement from the surface to the reinforcement.

.3 In beams, columns, walls, and slabs exposed to view after form removal: Small concrete blocks made up of the same color and strength as concrete being placed around them.

.4 Do not use plastic or stainless-steel bar supports or side form spacers.

.5 Design and fabricate special bar support for top reinforcing bars in slabs where standard bar supports are not high or strong enough.

.5 Mechanical Splices:

.1 Mechanical Threaded Connections: Furnish metal coupling sleeve with internal threads engaging threaded ends of bars, capable of developing in tension or compression 125 percent of yield strength of bar.

.1 Conform to CSA A23.3:19.

.2 Provide a thread-in plastic plug to protect the threads.

.3 Wrap exterior with tape.

.4 Clip the mounting washer, if provided, to maintain cover without displacing the bar.

2.2 FABRICATION

.1 Fabricate and bend reinforcing steel in accordance with CAN/CSA-A23.1:19/A23.2:19, RSIC Manual of Standard Practice, and in accordance with the accepted placing drawings.

.2 Reinforcing Bars:

.1 Use the longest bar possible.

.2 Shear and bending Tolerances:

.1 Length: ±25 mm.

.2 Outside dimensions of stirrups, ties, and spirals: ±13 mm.

.3 Other bends: ±25 mm.

.4 Where increases cause interference with water stop- plus 0 mm.

.5 Ensure cutting and bending tolerances are sufficiently accurate to comply with placing tolerances shown.

.3 Keep the number of splices to a minimum.

.4 Do not weld chairs, bolsters, bar supports, or spacers to reinforcing bars.

.5 Reinforcing Splices:

.1 Lap Splices: Splice by lapping reinforcing bars, unless specified otherwise in the Contract Documents.

.2 Welded Splices: Full penetration direct butt splice welds in accordance with CSA W186 and as specified in the Contract Documents.

.3 Obtain prior written approval from the Consultant for locations of reinforcement splices other than those shown on the placing drawings.

.6 Bend bars cold, heating of bars will not be permitted.

.7 Verify elevations before cutting and bending reinforcing bars.

.8 Obtain written approval from the Consultant prior to welding reinforcement. Weld reinforcement in accordance with CSA W186-M.

3 Execution

3.1 PREPARATION

.1 Notify the Consultant a minimum of one week in advance of when the reinforcing is ready for inspection.

.2 Clean reinforcing bars of loose rust, mill scale, dried cement paste, mud, oil, or other coatings that will affect adhesion in accordance with CSA A23.1:19/A23.2:19, Clause 6.1.5 – Surface Condition of Reinforcement, before placing concrete.

.3 Coat wire projecting from bar supports with dielectric material or plastic.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement without prior written approval by the Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure. The required radius of bend shall be provided in accordance with CSA A23.4.

.3 Replace bars that develop cracks or splits.

3.3 REINFORCEMENT BAR INSTALLATION

.1 Before installation of reinforcing steel, inspect installed Work of other trades and verify that Work is complete for installation of reinforcement.

.2 Place reinforcing steel as shown on reviewed placing drawings and in accordance with CSA A23.1:19/A23.219.

.3 Use plain round bars as slip dowels in concrete.

.1 Paint the portion of the dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 When paint is dry, apply a thick even film of mineral lubricating grease.

.4 Tie bars at least at every fourth intersection minimum. Make maximum untied length 1000 mm.

.5 Do not eliminate or displace reinforcement to accommodate hardware to be embedded in concrete.

.6 Do not field bend bars partially embedded in concrete except as shown on the Contract Drawings or as accepted by the Consultant.

.7 Before placing concrete or closing wall and column forms, obtain acceptance of reinforcing steel and position from Consultant.

.8 Ensure cover to reinforcement is maintained during the concrete pour.

.9 Splicing:

.1 Use lap splices, unless otherwise shown on the Contract Drawings or permitted in writing by the Consultant.

.2 Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent yield strength of bar in tension and compression.

.3 Stagger splices in adjacent bars.

.10 Dowel Bar Splicers:

.1 Use only in areas specifically approved in writing by the Consultant.

.2 Install threaded rods as recommended by the manufacturer with threads totally engaged into the coupling sleeve and in accordance with the ICBO Research Report.

.3 Install dowel bar splicers with plastic setting plugs.

.4 Lightly grease internal threads in accordance with the manufacturer's printed instructions.

.5 Maintain minimum edge distance and the concrete cover as noted in the Contract Drawings.

.11 Mechanical Splices:

.1 Install mechanical splices in accordance with the manufacturer's written instructions. Request the presence of the manufacturer's representative to verify proper installation.

.12 Tying Reinforcing Bars:

.1 Bend tie wire away from the concrete surface. Ensure that the cover for tie wires, form tie bolts, etc. are the same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.

.13 Reinforcement Around Openings: On each side and above and below the pipe or opening, place an equivalent area of steel bars to replace steel bars cut or disrupted for opening. Extend steel reinforcing a standard lap length beyond the opening at each end.

.14 Welding Reinforcement:

.1 Get the Consultant's approval for welding reinforcing steel.

.2 Only Type W bars may be welded.

.3 Do not perform welding until welder qualifications are approved.

.4 Do not field cut reinforcement except where indicated or authorized in writing by the Consultant

3.4 PROGRESS CLEANING

.1 Leave the Work areas clean at end of each Working Day.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labor, materials, equipment, services and perform all operations required to complete cast-in-place concrete installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Formwork and Falsework

.2 Section 03 20 00 – Concrete Reinforcing

.3 Section 03 35 00 – Concrete Finishing

1.3 REFERENCE STANDARDS

.1 The National Building Code – 2019 Alberta Edition (NBC – 2019 AE)

.2 CSA International:

.1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3:19, Design of Concrete Structures

.3 CSA A283, Qualification Code for Concrete Testing Laboratories.

.4 CSA A3000, Cementitious materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.5 CAN/CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.

.3 ASTM International:

.1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

.4 . ASTM C1017/C1017M, Standard specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).

.6 ASTM C1059/C1059M, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

.7 ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

.4 American Concrete Institute (ACI):

.1 ACI 306.R, Guide to Cold Weather Concreting.

.2 ACI 351.1R, Grouting between Foundations and Bases for Support of Equipment and Machinery.

.5 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-19.24

.2 CAN/CGSB 37.2-M, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Damp proofing and Waterproofing and Roof Coatings.

.3 CAN/CGSB 51.34-M, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.4 ABBREVIATIONS AND ACRONYMS

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.

.2 Type MS or MSb – Moderate sulphate-resistant cement.

.3 Type MH or MHb - Moderate heat of hydration cement.

.4 Type HE or Heb - High early-strength cement.

.5 Type LH or LHb - Low heat of hydration cement.

.6 Type HS or HSb – High sulphate-resistant cement.

.2 GGBFS - Ground, granulated blast-furnace slag.

1.5 DEFINITIONS

.1 Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures including surfaces above water.

.2 Surface Defects: Surface areas that include honeycomb, rock pockets, indentations greater than 5 mm, cracks 0.25 mm wide and larger, spalls, chips, air bubbles greater than 20 mm in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form pop-outs, texture irregularities, and stains and other colour variations that cannot be removed by cleaning.

.3 Defective concrete: As defined in subsection 1.6.5 – Defective concrete, below.

.4 New Concrete: Less than 60 Days old.

1.6 QUALITY ASSURANCE

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

.2 The Contractor shall be fully responsible for quality control of all aspects of production, pre placement, placement, and post-placement of concrete and related testing. Consultant's review shall not relieve the Contactor of its responsibility for quality and workmanship.

.3 Testing of cast-in-place concrete shall be performed by a CSA A23.1 certified independent testing agency. Testing shall conform to CSA-A23.2. Independent testing shall be paid for by the Contractor.

.4 Ready Mixed Concrete Producer: Certified member in good standing of the Ready Mixed Concrete Association of Alberta.

.5 Inspection and tests:

.1 Materials: CSA A23.1:19/A23.2:19.

.2 Tests will be performed in accordance with CSA A23.1/A23.2.

.3 Cooperate with and assist the independent testing agency during inspections and tests.

.4 Allow ample time for inspection and corrective work, if required, before scheduling concrete placement.

.6 Remove defective materials and completed work that fails tests and replace them as directed by the Consultant.

.7 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control nor relieve the Contractor of its contractual responsibility.

.8 Defective concrete:

.1 Concrete strength:

.1 Strength acceptance criteria from cylinder tests will be in accordance with CSA A23.1:19/A23.2:19.

.2 Concrete shall be considered defective when a cylinder test fails to meet the performance requirements for the corresponding concrete type, as defined in subsection 2.2 – Concrete Mixes, below.

.3 In such cases, the Consultant may require further action or testing in accordance with CSA A23.1, Clause 4.4.6.7 – Failure of Standard-Cured Cylinder Test Results to Meet Requirements.

.2 Concrete may be considered defective if it is structurally unsound, lacks moisture resistance, has surface defects, the measured air content fails to meet performance requirements, or is improperly finished, as determined by the Consultant.

.3 The Consultant has the right to require replacement, strengthening, or correction of impacted portions of defective concrete structure, in accordance with Clause 4.4.6.7.2 of CSA A23.1:19.

.4 The Contractor shall bear all costs of rectifying defective concrete including inspections, design, coring, testing, strengthening, demolishing, and replacement. The Contractor shall also bear investigation and evaluation costs even if further evaluation of the design allows the unit to be classified as acceptable concrete.

.9 Concrete delivery:

.1 There shall be a maximum time limit of 120 minutes from the time of initial mixing to complete discharge, in accordance with CSA A23.1 Clause 5.2.4.3.1 – Time of Delivery.

.10 Records:

.1 Before unloading at the Site, have the concrete producer submit to the Consultant a delivery ticket (with each batch of concrete) on which is printed, stamped or written the following information:

.1 Name and location of batch plant.

.2 Date and serial number of tickets.

.3 Name of Contractor.

.4 Contract Name and Contract Number.

.5 Concrete Mix Design Submission Form number, specified strength, target slump, and air content at the end of the chute.

.6 Amount of concrete in cubic meters.

.7 Truck number, cumulative total, and/or load number.

.8 Time loaded or time of first mixing of cement and water/aggregate.

.11 Include the following information, which is to be registered by the producer's representative on at least two copies of the delivery ticket, after discharge has been completed:

.1 Time that load arrived on Site.

.2 Time that discharge of load was started.

.3 Time that discharge of load was completed.

.4 Type and amount of admixtures. If added at the Site, initialed by the Consultant.

.5 Maintain accurate records of cast-in-place concrete elements. Include in the records the following information:

.1 Date of placing concrete element.

.2 Location of the concrete element.

.3 Specified strength of concrete.

.4 Air and form temperature when concrete was placed.

.5 Temperature of concrete when placed in the form.

.6 Test samples taken and results of test samples.

1.7 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Certificates:

.1 Submit a current, valid “Certificate of Ready Mixed Concrete Production Facilities” as issued by the RMCAO for plants supplying concrete to the Contract.

.2 Submit certification from the concrete producer that a Professional Engineer licensed in the Province of Alberta has designed the mixes based on the requirements of the drawings and that the concrete mixes will produce concrete meeting the performance requirements of the Specification Sections.

.3 Submit certification demonstrating that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete. Ensure these tests are current and represent the aggregates being supplied.

.4 Submit certifications with the concrete mix design, that all concrete constituents are compatible.

.5 Statements identifying the sources and certifying that Aggregates comply with CAN/CSA - A23.1 and are from approved sources.

.6 Gradations, materials, plant, and equipment to be used in concrete work comply with the requirements of CAN/CSA-A23.1:19.

.3 Quality Control Plan:

.1 Submit for review by the Consultant the Quality Control Plan which describes the material, equipment, and procedures to be used for the following activities:

.1 Uniform and consistent concrete finishing.

.2 Cold weather protection when the air temperature is at or below 5 degrees Celsius.

.3 Hot weather protection when the ambient air temperature is at above 27 degrees Celsius.

.4 Concrete curing.

.5 Concrete placing.

.6 Temperature Management Plan including temperature monitoring and corrective measures.

.7 Submit concrete delivery records.

.2 Records

.3 Concrete pours: Maintain and submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken, as described in subsection 3.8 - Field Quality Control, below.

.4 Concrete hauling times: Maintain and submit records of deviations from the maximum allowable time of 120 minutes for concrete delivery.

.4 Shop Drawings:

.1 Master Plan(s) of Concrete Placements:

.1 Before submitting shop drawings of formwork, falsework and reinforcing bars, submit master plan(s) showing separate concrete placements and the locations of all expansion, isolation, control and construction joints, including any proposed construction joints that are in addition to those indicated on the Contract Drawings.

.2 Show layout and location for each type of joint, including expansion and construction joints.

.3 Show elevation or section taken through the plane of the joint showing the walls and slabs at the joint.

.4 Show details of joint fillers, sealant, adhesives, and other appurtenances.

.5 Show details of concrete inserts, including location, size, type and surface treatments.

.2 Concrete Placing Schedule:

.1 Submit concrete placing schedule.

.5 Concrete Mix Designs:

.1 Submit proposed performance mix design data and the Supplier's applicable standard deviations.

.2 Tabulate concrete mixes. Indicate the types of cement, size of coarse aggregate, water/cementing material ratio, admixtures used, air content, slump, and the locations of use for each mix.

.3 For high slump flowing concrete submit a mix that will not result in segregation.

.6 Field Quality Control Test Results:

.1 Submit reports of results for each of the following field tests, as described in subsection 3.8 – Field Quality Control, below:

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 Days.

.5 Air and concrete temperature.

.7 Product Data:

.1 Submit technical data where noted with quantities, of proposed materials including installation, application, and maintenance instructions for:

.1 Joint filler (100 mm length of each type).

.2 Curing compound.

.3 Evaporation retardant.

.4 Surface sealer.

.5 Floor hardener.

.6 Chemical hardener.

.7 Polyethylene sheet.

.8 Submit a Construction Waste Management plan as described in subsection 3.16 – Cleaning, below.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Comply with the manufacturers' recommendations for delivery, storage, and handling.

.2 Store materials in a manner that will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from the Site.

.3 Concrete:

.1 Deliver and store materials on Site in accordance with CSA A23.1/A23.2.

.2 Site-mixed concrete shall not be permitted.

.3 Concrete, mixed off-Site:

.1 When the truck mixer or agitator is accepted for mixing or delivery of concrete, do not add admixtures or water to batch after the initial introduction of mixing.

.2 If measured slump or entrained-air content falls outside specified limits, ensure another portion of the same sample is tested immediately. If second failure occurs, concrete will be considered to have failed the requirements of the Specification and will be rejected.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials.

1.9 SITE CONDITIONS

.1 Do not place concrete during or before rain.

.2 Prevent rain from reaching newly placed concrete in accordance with CSA A23.1:19/A23.2:19

.3 Cold weather protection:

.1 Maintain protection equipment, in a state of readiness, on Site. Use such equipment when the ambient temperature is at or below 5 degrees Celsius, or when, in the opinion of the Consultant the temperature may fall below 5 degrees Celsius before concrete has cured.

.2 Do not place concrete upon or against a surface that is at a temperature lower than 5 degrees Celsius.

.3 Provide temperature-controlled enclosures for areas where concrete is placed whenever ambient air temperature is 5 degrees Celsius or lower.

.4 Protect concrete from the adverse effects of space-heated enclosures including local overheating and combustion products.

.5 Heat mix water and, if necessary, aggregate when air temperature is at or below, or predicted to go below, 5 degrees Celsius at any time during the next 24 hours.

.6 Maintain the temperature of reinforcing bars and forms above 10 degrees Celsius before placing concrete.

.7 Maintain the temperature of concrete when deposited in forms not less than 15 degrees Celsius but not higher than 25 degrees Celsius.

.8 Maintain the temperature of concrete at surfaces at least 10 degrees Celsius for a minimum period of seven days after placing and achieving a minimum 75 percent of specified strength. Concrete temperature may then be lowered to ambient air temperature at a rate of 0.5 degrees Celsius per hour or 10 degrees Celsius per day.

.9 Use additional protection if full 28 Day compressive strength is required at an early age.

.10 Keep concrete continuously moist during the curing period.

.11 Obtain the Consultant's acceptance of the method of maintaining minimum temperatures.

.4 Hot weather protection:

.1 Maintain protection equipment in a state of readiness on Site. Use such equipment when the ambient temperature is at or above 27 degrees Celsius, or when, in the opinion of the Consultant the temperature may exceed 27 degrees Celsius before concrete has cured.

.2 When ambient temperature is at or above 27 degrees Celsius, protect concrete from direct sunlight and keep forms moist by sprinkling with cool water, applying wet burlap, or other accepted methods of cooling that will not adversely affect the concrete.

.3 Do not place concrete when the concrete temperature exceeds 27 degrees Celsius in the mixer.

.4 Concrete, which has a temperature in the mixer between 20 degrees Celsius and 27 degrees Celsius shall:

.1 Contain a retarder that reduces mixing water requirements and increases strength.

.2 Not contain high early strength cement.

.5 Protect forms and equipment, including both mixing and placing equipment, from the rays of the sun and cool by wetting as necessary to maintain a

temperature of not more than 5 degrees Celsius in excess of the ambient temperature nor more than 30 degrees Celsius.

.6 Before placing concrete, wet down forms and reinforcement and the area surrounding the work. Ensure that excess water is swept and drained away immediately before casting the concrete.

.7 Keep mixing time to the minimum, consistent with the production of the quality of concrete specified, and place mixed concrete immediately.

.8 Use sufficient qualified personnel for rapid placing and finishing of concrete.

.9 Commence continuous wet curing as soon as the concrete has hardened sufficiently to prevent surface damage.

.5 Protection from drying:

.1 When the rate of surface moisture evaporation exceeds 0.50 kg/m2/h, take additional measures to prevent rapid loss of moisture from the surface of the concrete as accepted by the Consultant and in accordance with CSA A23.1:19 Clause 7.4.1.2 – Severe Drying Conditions.

.6 Frost Protection for Footings and Slabs on Grade:

.1 Protect subgrades below the proposed concrete work. Ensure that subgrade temperatures are a minimum of 10 degrees Celsius when the concrete is placed.

.2 Provide continuous protection for footings and slabs on grade to prevent the sub-grade below from freezing during cold weather. Provide heated enclosures and insulation as required.

.7 Influence of Ambient Concrete Temperature on Concrete Crack Control:

.1 To minimize the formation of thermal cracks during placement and curing, maintain previously cured concrete and concrete that will be placed against it at the same temperature.

.2 Failure to minimize temperature differential between adjacent pours may result in temperature-induced cracking. Repair such cracks as specified in this Section.

.8 Backfilling and Service Loads Restrictions:

.1 Obtain approval from the Consultant before backfilling around structures.

.2 Verify that the backfill is not higher than the finished grades indicated in the Contract Documents.

.3 Verify that equipment for backfilling and compaction on top of slabs will not impose loads greater than those indicated in the Contract Documents.

.4 Verify that concrete in walls, and slabs, struts, and cross walls, which frame into the walls providing lateral stability, has been placed and has attained the specified compressive strength before backfilling against walls or subjecting walls to service loads.

.5 Verify that concrete in slabs, including slabs on grade supported by piles or caissons, and support components, have reached the specified compressive strengths before backfilling or subjecting slabs to service loads.

2 Products

2.1 MATERIALS

.1 General:

.1 Use admixtures for concrete conforming to CSA A23.1:19/A23.2:19, unless otherwise acceptable to the Consultant.

.2 Have the concrete producer certify that the admixtures are compatible.

.3 Use Products in accordance with the manufacturer's printed instructions unless otherwise acceptable to the Consultant.

.4 Fresh concrete to be normal density concrete (2350 kg/m^3 ± 100 kg/m^3), unless otherwise noted in Part 2.2 – Concrete Mixes.

.2 Cement and supplementary cementing materials: in accordance with CSA A3001:

.1 For use in general concrete construction, when the special properties of other cement types are not required, Portland cement Type GU or blended hydraulic cement type GUb shall be used.

.2 Should the Contractor choose to include silica fume cement in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of Portland cement.

.3 Should the Contractor choose to include fly ash in the concrete mix design, the substitution of fly ash shall not exceed 25% by mass of Portland cement.

.4 Should the Contractor choose to include a Ground Granulated Blast Furnace Slag (GGBFS) in the concrete mix design, the substitution of GGBFS shall not exceed 50% by mass of Portland cement unless specifically accepted by the Consultant.

.3 Aggregates:

.1 Coarse aggregates: In accordance with CSA A23.1:19/A23.2:19. All aggregate sources as listed on the MTO's designated Source Materials (DSM) list.

.2 Fine aggregates: In accordance with CSA A23.1/A23.2.

.4 Water: in accordance with CSA A23.1:19/A23.2:19.

.5 Admixtures:

.1 Air entraining admixture: in accordance with CSA A23.1:19/A23.2:19 and ASTM C260/C260M.

.2 Chemical admixture: in accordance with CSA A23.1:19/A23.2:19, ASTM C260 and ASTM C494. The Consultant is to approve accelerating or set retarding admixtures during cold and hot weather places.

.1 Water-reducing admixture: ASTM C494/C494M, Type A.

.2 Retarding admixture: ASTM C494/C494M, Type B.

.3 Accelerating admixture: ASTM C494/C494M, Type C.

.4 Water-reducing and retarding admixtures: Type D.

.5 Water-reducing and accelerating admixture: Type E.

.6 Water-reducing high range admixture (super plasticizers): Type F.

.7 Water-reducing, high range and retarding admixtures (super plasticizers): Type G.

.8 Specific performance admixtures: Type S.

.6 Curing compound: to CSA A23.1:19/A23.2:19

.7 Non-shrink grout: Shrinkage compensating grout, a pre-mixed compound consisting of non-metallic aggregate, Portland cement, water reducing, and plasticizing agents to CSA A23.1:19/A23.2:19.

.1 Compressive strength: 50 MPa at 28 Days.

.8 Non-premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 Days.

.9 Dry Pack Material: One part cement and three parts sand (fine aggregate) by volume. Add water to obtain a consistency that when a sample is squeezed, only enough water will come to the surface to moisten the hand. Maximum water content shall be 4.5 L to 23 kg of cement.

.10 Dovetail anchors and slots: Minimum 0.64 mm thickness, Z275 zinc coated galvanized steel with fillers to prevent entry of concrete during pouring and minimum 2 mm overall thickness.

.11 Rigid insulation: In accordance with CAN/ULC S701 Type 4, extruded polystyrene.

.12 Drilled Anchors:

.1 Epoxy Anchors

.1 HIT-HY 200 System by Hilti (Canada) Corporation.

.2 AC200+™ by DeWalt (Canada) Corporation.

.3 AT-XP® by Simpson Strong-Tie Corporation.

.13 Premoulded joint fillers:

.1 Bituminous impregnated fibre board: in accordance with ASTM D1751.

.2 Sponge rubber: in accordance with ASTM D1752, Type I, flexible firm grade.

.3 Self-expanding Standard cork: in accordance with ASTM D1752, Type III.

.14 Surface hardener:

.1 Factory premixed natural emery aggregates with Type GU normal Portland cement, superplasticizers and wetting agents:

.1 EmeriCrete SH by Sika Canada Inc.

.2 CPD Floor Hardener Pre-mix (Premium) by CPD Construction Products.

.3 MBT brand, Mastercron Ff by BASF – Building Systems.

2.2 CONCRETE MIXES

.1 Performance Requirements:

.1 Proportion concrete for structures to create high-performance concrete with improved durability, reduced shrinkage, and reduced cracking.

.2 Density: Normal density.

.3 Linear Shrinkage:

.1 Limit linear shrinkage to 0.040% after 28 Days of drying for 40 mm aggregate concrete and 0.045% after 28 Days of drying for 20 mm aggregate concrete.

.4 Durability Design Life

.1 Provide concrete produced under this Section with an expected design life of at least 70 years for the service conditions defined by the usage, and the exposures specified in the Contract Documents.

.2 General:

.1 Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete with strength and other properties specified, in accordance with CSA A23.1/A23.2.

.2 Design concrete so that material will not segregate, and excessive bleeding will not occur.

.3 Use the same types and brand of cement throughout.

.4 Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1:19/A23.2:19, Clause 4.4.6.7 Compressive Strength Requirements.

.5 Admixtures plant added with the mix water.

.3 Unshrinkable fill: Alberta Provincial Standard Specification.

.4 Non-Shrink Grout:

.1 For temperature at 0°C and above.

.2 For temperatures below -1°C, the Contractor shall heat and hoard the pour area to maintain a substrate and ambient temperature of 0°C and above. This temperature shall be maintained until the curing time specified by the manufacturer has been reached.

.3 Follow all product manufacturer instructions for non-shrink grout installation.

.4 Premixed, flowable, non-shrink grout without aggregate fillers.

.5 Manufacturer’s Products:

.1 CPD Non-Shrink Grout Pre-Mix (High Early Strength) by CPD Construction Products.

.2 SikaGrout 212 HP by Sika Canada Inc.

.3 NS Grout by The Euclid Chemical Company (Euclid Canada), a division RPM, Inc.

.5 Mixes for Normal Density Concrete:

.1 High-performance concrete for footings:

.1 Class N exposure.

.2 25 MPa at 28 Days.

.3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm unless the slab is less than or equal to 400 mm thickness.

.2 High-performance concrete for piers, foundation walls, and retaining walls:

.1 Class C-1 exposure.

.2 30 MPa at 28 Days.

.3 Air content category 2.

.3 High-performance concrete for interior slabs, including slabs-on-grade and slabs-on-deck:

.1 Class N exposure.

.2 30 MPa at 28 Days.

.4 Exterior reinforced concrete slabs, SCRUBBER DUMP PARKING SLAB:

.1 Class C-1 exposure.

.2 35 MPa at 28 Days.

.3 Air content category 1.

.4 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.

.5 Exterior unreinforced concrete slabs, pavements, sidewalks and curbs:

.1 Class C-2 exposure.

.2 32 MPa at 28 Days.

.3 Air content category 1.

.4 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.

.6 Lean fill, pipe bedding, duct banks, encasements, underpinning and skim slabs:

.1 Class N exposure.

.2 15 MPa at 28 Days.

.3 Maximum aggregate size 20mm.

.6 Mix for Pumped Concrete:

.1 Comply with the requirements of ACI 304.2R and this Section.

.2 Use coarse and fine aggregate with a uniform grading curve.

.3 Super plasticizing admixture may be used for pumped concrete.

.4 Do not use admixtures which promote bleeding.

3 Execution

3.1 RELEASES

.1 Obtain the Consultant's release:

.1 For reinforcement, formwork, falsework, and inserts as placed.

.2 To commence placing concrete.

.2 Provide the Consultant with written notice of the Contractor's intent to pour between 24 hours and 7 Days before the pour.

.3 Provide a completed Concrete Pour Release Form before each pour and allow the Consultant 2 hours for their review.

.4 Do not order concrete until the Concrete Pour Release Form has been signed by the Consultant.

3.2 PREPARATION

.1 Obtain approval from the Consultant before placing concrete. Provide 24 hours minimum notice before the placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 – Concrete Reinforcing.

.3 Remove water, snow, ice, loose soil, laitance, curing compound, wood, and other debris from surfaces on or against which new concrete will be placed.

.4 Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.

.5 During concreting operations:

.1 The development of cold joints shall not be allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum re-handling and without damage to the existing structure or Work.

.6 Pumping of concrete is permitted only after the approval of equipment and mix.

.7 Ensure reinforcement and inserts are not disturbed during concrete placement.

.8 Before placing concrete, obtain the Consultant's approval of the proposed method for the protection of concrete during placing and curing.

.9 Protect the previous Work from staining.

.10 Clean and remove stains before application for concrete finishes.

.11 Maintain accurate records of poured concrete items to indicate the date, location of pour, quality, air temperature, and test samples taken.

.12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with non-shrink grout to anchor and hold dowels in positions as indicated in the design drawings.

.13 Do not place load upon new concrete until authorized by the Consultant.

3.3 MAXIMUM SIZE OF CONCRETE PLACEMENTS

.1 Limit the size of each placement to allow for strength gain and volume change due to shrinkage.

.2 Consider beams, girders, brackets, column capitals, and haunches as part of the floor or roof system above and place monolithically with the floor or roof system.

.3 Construction Joints in Unrestrained Slabs on Ground:

.1 Base Slabs placed on the ground may be placed continuously from outside edge to outside edge, outside edge to expansion joint, or from expansion joint to expansion joint, unless shown otherwise on the Drawings.

.4 Construction Joints in Suspended Slabs Restrained by Connecting Walls:

.1 Place slab in alternate strips with the larger dimension of any single placement no greater than 15,000 mm for slabs.

.2 Locate construction joints in suspended slabs near the middle quarter of the spans of slabs and beams, unless indicated otherwise on the Contract Drawings. If a beam intersects a girder at this location, offset the construction joint in the slab and girder by a distance equal to two times the depth of the beam.

.5 Construction Joints in Girders and Beams:

.1 Construct concrete beams and suspended slabs monolithically, unless indicated otherwise on the Contract Drawings.

.2 If vertical construction joints are required, provide shear key, and additional inclined shear reinforcing steel. The Consultant's review and acceptance is required for any joints added into girders and beams.

.6 Construction Joints in Walls:

.1 Limit pours to a maximum of 6.5 m vertically.

.2 Allow 3 Days between adjacent pours.

.3 Locate construction joints a minimum of 2,000 mm away from any junction of two or more walls, a column or beam supported on a wall, the nearest edge of an opening wider than 600 mm, and a construction joint in a slab on which the wall rests.

.4 Place wall in alternate portions with a distance between vertical construction joints not exceeding 15,000 mm for walls.

3.4 INSTALLATION/APPLICATION

.1 Prevent damage to waterproofing where concrete is poured against waterproofing.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, slab drop panels, column capitals or columns, except where indicated or approved by Consultant.

.2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere in the Contract Documents.

.3 Sleeves and openings greater than 100 x 100 mm not indicated in design drawings must be reviewed by the Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from the Consultant before the placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on the Drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.7 Obtain all requirements, and provide for mechanical bases, pits, sumps and trenches not shown on the structural drawings.

.3 Anchor rods:

.1 Before placing concrete, place anchor bolts in locations indicated on the reviewed shop drawings under the supervision of the trade supplying anchor bolts and templates in accordance with the manufacturer's printed instructions and in accordance with CSA A23.1:19/A23.2:19.

.4 Grout under base plates:

.1 Grout under base plates using procedures in accordance with the manufacturer's recommendations that result in 100% contact over the grouted area. Thoroughly compact leaving no voids.

.5 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated on the Drawings and as described in this Section.

.6 Horizontal Construction Joints in Reinforced Concrete Walls and Columns:

.1 Thoroughly clean and saturate the surface of the joint with water.

.2 For walls and columns, place grout onto the existing concrete before starting regular concrete placement. Limit wall and column grout placement to a maximum thickness of 50 mm and a minimum thickness of 30 mm.

.7 Dovetail anchor slots:

.1 Install continuous vertical anchor slots to forms where masonry abuts concrete wall or columns.

.2 Install continuous vertical anchor slots at 800 mm o.c. where concrete walls are masonry faced. Anchors shall project to within 20 mm minimum of masonry face.

.3 Do not install anchor slots in underground concrete walls cast against excavation support systems.

3.5 PROTECTION AND CURING

.1 Protect and cure concrete in accordance with CSA A23.1:19, Clause 7.4 and Table 20.

.2 Protect freshly placed and finished concrete from adverse conditions such as premature drying, moisture loss, defacement due to building operations, and excessive hot and cold temperatures, for the period corresponding to the required curing type of concrete.

.3 Commence protection immediately after placing to achieve the temperature and moisture conditions for the period necessary for the concrete to develop its required properties.

.4 Concrete elements shall be protected to limit the temperature differential between the concrete core and the concrete surface within 20°C.

.5 Protection shall not be removed until the concrete has cooled to the temperature differential given in the CSA A23.1:19, Table 21, in order to avoid cracking of the concrete due to the sudden temperature change near the end of the curing period.

.6 Removal of forms prior to the minimum curing period does not remove the Contractor’s obligation to cure and protect the exposed concrete for the minimum time periods specified for curing and protection. Refer to CSA A23.1:19, Clause 7.4.1.5.3.4.

.1 Curing types based on CSA A23.1:19, Table 20, as modified in this Section:

.1 Type 1 – Basic curing: Three days at ≥10°C or for the time necessary to attain 40% of the specified strength.

.2 Type 2 - Additional curing: Seven days total at ≥10°C and for the time necessary to attain 70% of the specified strength.

.3 Type 3 - Wet curing: Seven days at ≥10°C and for the time necessary to attain 70% of the specified strength.

.4 Note: Silica fume concrete must be wet-cured.

.7 Wet Curing of Concrete:

.1 When wet curing is required, start fog misting immediately after placing operations are completed, to prevent plastic shrinkage and cracking from taking place.

.1 Fog misting must be applied continuously from the time of screeding until the concrete is covered with burlap or other moisture-retaining covering, in such a way as to maintain high relative humidity above the concrete and prevent drying of the concrete surface.

.2 When concrete has set, cover horizontal surfaces with at least one layer of wet burlap or other moisture-retaining covering.

.1 Strips must overlap 150 mm and must be held in place without marring the surface of the concrete.

.2 Provide suitable weights to prevent blow-off or displacement of protective cover.

.3 Burlap must be pre-soaked by immersing it in water for a minimum period of 24 hours before placing it and must be maintained in a continuously wet condition throughout the curing period by means of a soaker hose.

.4 Do not permit intermittent drying.

.5 Remove burlap after a minimum of 7 consecutive Days and allow to air dry until the concrete has developed the specified design strengths.

.3 Water must not be allowed to drip, flow or puddle on the concrete surface during fog misting, when placing the burlap or at any time before the concrete has achieved final set.

.8 Use of Curing Compounds and Evaporation Reducers:

.1 Except where concrete wet curing is required, the use of pigmented curing compounds and evaporation reducers may be authorized by the Consultant.

.2 Apply curing compound/evaporation reducer after placing or finishing operations have been completed, in accordance with the compound manufacturer’s printed instructions.

.3 Ensure the compound application is uniform and continuous over entire area being cured.

.4 Where surfaces are to be exposed to sunlight, use compound with white pigment.

.5 Do not use curing compounds on surfaces where a bond is required for additional concrete or where a bonded surface coating such as paint, tile, resilient flooring, and similar materials are to be applied.

.9 Curing Plan:

.1 Detailed curing plan containing (at minimum) the duration of curing, the manner in which the surface will be kept moist, type of curing material, and

provisions to address potential problems (for example, high winds or extreme weather conditions) shall be prepared by the Contractor and submitted for review by the Consultant as part of the Work plan requested in subsection 1.6, above.

3.6 FINISHING

.1 Treat and finish exposed formed surfaces in accordance with CSA A23.1.

.2 Grout tie holes in concrete flush to the concrete surface. Grout with finishing cement mortar using the same sand and cement as used in the concrete.

.3 Pack grout into place to fill the tie hole and finish to match the adjacent concrete surface.

.4 After the removal of forms, strike off projections, and fill honeycombing and defects in accordance with CSA A23.1:19/A23.2:19.

.5 Refer to honeycombed areas for inspection and designation as structural or non-structural and repair as directed by the Consultant.

.6 Floor finish classification: Class A in accordance with Table 22 of CSA A23.1:19.

.7 Except where indicated otherwise in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents, follow the follow finishing schedule:

AREA	**Type of Finish**
Wall Surfaces – Exterior:	
1. Above grade/exposed (above a point 150 mm below finish grade)	Number 6 Finish
2. Above grade/covered with brick veneer or other finish material	Number 5 Finish
3. Backfilled (below a point 150 mm below finish grade)	Number 4 Finish
Slabs – Upper Surface:	
4. Firing Range floor slab and Shipping & Receiving floor slab	Number 2 Finish
5. Exterior roof slab/covered with roofing or waterproofing material	Number 1 Finish
6. Other exterior slabs	Number 2 Finish
7. Stairs and landings	Number 3 Finish
8. Top of interior buildings slabs	Number 2 Finish
9. Top of interior slabs to receive mortar setting bed for tile	Number 7 Finish
10. Top of interior slabs to receive resilient flooring or carpet, chemical resistant coating, special flooring, tiles on thin set mortar	Number 2 Finish
11. Equipment bases	Number 2 Finish
12. Where shake on hardener is applied	Number 2 Finish

.8 Finish type other than those indicated in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents shall be as follows:

.1 Number 1 Finish (Wood Float):

.1 After screeding by accepted method to obtain required floor tolerances, work the surface by means of a wood float in such a manner that after concrete has hardened, no portion of surface shows a variation of more than that specified.

.2 Number 2 Finish (Trowelled):

.1 After screeding and compaction with a wooden float, bring the surface to a smooth level and dense finish free from trowel marks, ridges and depressions by means of steel trowels operated either by hand or by mechanical means.

.2 Do not sprinkle dry cement or sand on the surface during the trowelling process.

.3 Maintain ambient temperature at a minimum of 10°C when steel trowelling is in progress.

.3 Number 3 Finish (Broomed):

.1 Before the floated surface has fully hardened, brush the surface with a stiff broom in one direction to leave a rough surface.

.4 Number 4 Finish (Formed):

.1 As soon as forms have been removed and directions given by the Consultant, remove projections and fill honeycombing and defects.

.5 Number 5 Finish (Smooth Formed):

.1 As soon as forms have been removed and directions given by the Consultant, patch formwork tie holes, grind off projections, irregularities and rough spots, patch surface defective areas and repair rough spots. Provide a smooth uniform appearance.

.6 Number 6 Finish (Rubbed):

.1 As soon as forms have been removed and holes pointed, rub surface with an abrasive rubbing brick until form marks and blemishes are removed and the surface is smooth and of uniform texture and colour.

.2 Do not remove from a larger surface than can be rubbed to fine finish within 6 hours.

.7 Number 7 Finish (Floor to Receive Bonded Topping, Screed, Grout, or Porcelain Tile):

.1 Strike off and screed the concrete base slab to a level below the final floor surface equal to the specified thickness of the finish course as shown on the Drawings.

.2 Float the surface.

.3 Wire broom the surface to make 6 mm deep grooves at approximately 20 mm centres, running in one direction.

.9 Surface Hardener:

.1 In area(s) indicated to receive surface hardener, power screed the floor slab and float.

.2 Over freshly floated concrete applies surface hardener in accordance with the manufacturer's printed instructions.

.3 Distribute evenly, do not throw hardener.

.4 Float between applications of hardener and after second hardener application with power floats.

.5 Machine trowel to smooth, level, and dense surface of uniform colour, free from trowel marks, ridges, pinholes, and other defects.

.6 Have the manufacturer's representative on Site within 24 hours when requested by the Consultant.

.10 Ensure that the concrete finish is compatible with specified traffic topping or other applied finish.

.11 Production of smooth surfaces by means of cement plaster is not permitted.

3.7 CONSTRUCTION TOLERANCE

.1 Concrete tolerances shall be in accordance with CSA A23.1:19/A23.2:19 clause 6.4 - Construction Tolerances for Cast-in-Place Concrete, and subsection 1.5 – Quality Assurance, above.

3.8 FIELD QUALITY CONTROL

.1 Site tests: Conduct tests as follows in accordance with CSA A23.1:19/A23.2;19 and submit results as described in subsection 1.6 – Submittals, above.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 Days.

.5 Chloride ion content penetrability (for exposure class C-1 concrete).

.6 Air and concrete temperature.

.2 Concrete sampling, inspection and testing will be carried out by an independent testing laboratory appointed and paid by the Subcontractor upon approval of the Consultant.

.1 Ensure the testing laboratory is certified in accordance with CSA A283.

.2 Sampling, inspection and testing of concrete and concrete material shall be performed in accordance with CSA A23.1:19/A23.2:19.

.3 Three concrete test cylinders will be taken for every 50 m3 or less of each class of concrete placed.

.4 At least three test cylinders will be taken daily for each class of concrete placed. Atmospheric and concrete temperatures shall be recorded.

.5 One additional test cylinder will be taken during cold weather placement of concrete, and be cured on job site under same conditions as concrete it represents.

.6 One slump test and one air content test will be taken for each set of test cylinders taken. These tests shall be performed before the concrete from which the sample was taken is allowed to be incorporated into the concrete work.

.7 Verify quality of concrete with additional slump tests as required.

.8 Non-Destructive Methods for Testing Concrete: in accordance with CSA A23.1:19/A23.2:19.

.9 Inspection or testing by the Consultant will not augment or replace the Contractor’s quality control requirements nor relieve Contractor of any of its responsibilities under the Contract.

.10 Pay costs for required retesting due to results indicating defective materials or workmanship regardless of the results of the retesting.

3.9 LOADING OF STRUCTURE

.1 Do not load any portion of structure prior to achieving 70% of specified strength and only with the acceptance of the Consultant.

.2 Removal of forms prior to the minimum required curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum required time periods specified. Refer to subsection 3.5 of this Section above.

3.10 REPAIRING SURFACE CRACKS IN CONCRETE

.1 After concrete has set for a minimum of 28 Days, and before a maximum of 125 Days, examine surfaces carefully for cracks.

.2 Rout cracks larger than 0.3 mm at the discretion of the Consultant.

.3 Fill cracks with non-shrink grout.

.4 Match the surface to existing surfaces in quality, texture, colour, and elevation.

3.11 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

.1 Repair cracks in the completed structures employing a suitable polyurethane injection technique to make such cracks completely watertight after repair.

.2 Remove surface injection materials following the completion of the Work and finish the affected areas to match the surrounding concrete.

3.12 INJECTION OF CRACKS – POLYURETHANE GROUT

.1 Use materials in accordance with the manufacturer's printed instructions.

.2 Clean and prepare cracked areas in accordance with the manufacturer's recommendations.

.3 Inject polyurethane grout into cracks in accordance with the manufacturer's written instructions.

.4 Commence injection at the lowest injector on a vertical face and at one end on a horizontal surface. Continue injection until pure uncontaminated material flows out from adjacent injectors. Cap the injectors and proceed to adjacent injectors until all injectors have been filled.

.5 Upon completion, remove injectors and surface sealer. Thoroughly clean the concrete surfaces of excess grout material. Finish the surface to match the surrounding concrete.

.6 Patch injection holes.

3.13 SAWCUT JOINTS

.1 Time joint sawing to concrete setting. Start sawing as soon as concrete has hardened sufficiently to prevent aggregates from being dislodged by saw.

.2 Complete sawcutting before drying shrinkage stresses become large enough to produce cracking and in any event not more than 12 hours after concrete is placed.

.3 Sawcut joints in straight lines.

.4 For sawcut location, width, depth, and sealant protection in reinforced concrete slab, refer to Contract Drawings.

.5 Ensure that reinforcing steel is not cut or damaged.

.6 Sawcut depth in non-structurally reinforced concrete to be one-third of slab thickness unless otherwise indicated on Contract Drawings.

.7 Locate sawcut joints in accordance with submitted Shop Drawings.

.8 Give special consideration to areas of restraint to shrinkage such as at columns, re-entrant corners and sudden changes in width.

.9 Spray water on saw blade at all times during sawing.

.10 After sawing, clean joints with jet of water and blow-out with compressed air.

.11 Broom clean residue caused by sawing operation.

3.14 GROUTING

.1 Grout column base plates and miscellaneous Work with non-shrink grout in accordance with the grout manufacturer's printed instructions.

.2 Form around bases, place grout to ensure positive bearing of entire area of the steel plate on top of supporting surface.

.3 Thoroughly compact, leaving no voids.

3.15 PATCHING

.1 Carry out patching as specified in CSA A23.1:19/A23.2:19.

.2 Make good temporary openings left in concrete for pipes, conduits, ducts, shoring, and other Work during construction.

.3 Reinforce with welded wire fabric, as required, and finish to match the surrounding work.

.4 Mix, handle, and cure patching material according to manufacturer’s instructions.

.5 Immediately prior to patching clean, prepare, and remove free water from the surface.

.6 Finish flush with the surface of the surrounding concrete and remove excess.

3.16 SEALANT APPLICATION

.1 Do not fill joints sooner than 30 Days after concrete pours.

.2 Comply with the manufacturer’s printed instructions and curing and saw cutting requirements.

.3 Execute joint sealing during cool, dry ambient conditions when the slab is in a contracted state to minimize future joint separation at sealant filled joints.

.4 Fill sawn joints in concrete slabs full depth with sawcut joint sealant.

.5 Seal over pre-moulded joint filler with joint sealant.

.6 Comply with the sealant manufacturer's primer, application, and temperature requirements. Mask floor to edge of joints and fill joint with sealant.

.7 After initial set, prime sealant surface and refill joints with sealant as required to produce a slightly convex joint surface.

3.17 CLEANING

.1 Cleaning:

.1 Promptly as the Work proceeds and upon completion, clean-up and remove from the site, the rubbish and surplus material resulting from the Work of this Section.

.2 Leave the Work area clean at the end of each Day.

.3 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment.

.2 Waste Management:

.1 In accordance with Section 01 74 11 – Cleaning.

.2 Separate waste materials for reuse and recycling.

.3 Divert unused concrete materials from landfill to local quarry or facility after receipt of written approval from Consultant.

.4 Provide an appropriate area on Site where concrete trucks can be safely washed.

.5 Divert unused admixtures and additive materials (pigments, fibres) from landfill to an official hazardous material collections site as approved by Consultant.

.6 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.7 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.8 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.9 Dispose of waste in accordance with applicable local, provincial and national regulations.

END OF SECTION

1 General

1.1 SUMMARY

.1 Work of this Section includes the following for concrete slab and ground beam finishing, repair of existing concrete slabs to receive new finishes:

.1 Requirements for concrete floor penetrating sealer (SC),

.2 Requirements for floor flatness and levelness,

.3 Trowelling, leveling, and floating of floor surfaces for ready for applied finishes.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete

1.3 DEFINITIONS

.1 Floor Classifications: Classification of concrete floor slabs based on their intended use, methods of finishing, and finish materials applied to flooring as denoted by the F-rating below, and as follows:

.1 Single Course Floor: Floors placed in a single course with final finishing applied to properly leveled concrete.

.2 Ff: The maximum floor curvature allowed over 24 inches (0.61 m) computed based on successive 12-inch (0.30 m) elevation differential. Ff is commonly referred to as the "Flatness F-Number."

.3 Fl: The relative conformity of the floor surface to a horizontal plane as measured over a 10-foot (3.05 m) distance.

.4 Finish or Finishes: Materials applied to the finished concrete surface, i.e.: stained or coloured concrete, carpet, resilient flooring, or ceramic tile.

.5 Finishing: Methods, tools, and equipment employed to achieve levelness or surface flatness for shored slabs and slabs-on-grade, and durability indicated and as follows:

.1 Overall, Flatness/levelness of Ff50, Fl35, with a minimum local of Ff35, Fl25, in accordance with ASTM E1155.

1.4 REFERENCE STANDARDS

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

.1 ASTM C309, Standard Specification for Liquid Membrane-Forming Compound for Curing Concrete.

.2 ASTM C979/C979M, Standard Specification for Pigments for Integrally Colored Concrete.

.3 ASTM E1155, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

.2 American Concrete Institute (ACI):

.1 ACI 117, Specifications for Tolerances for Concrete Construction and Materials and Commentary

.2 ACI 301, Specifications for Structural Concrete for Buildings.

.3 ACI 302.1R, Guide for Concrete Floor and Slab Construction

.3 American National Standards Institute:

.1 ANSI A326.3, American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials.

.4 Canadian Standards Association (CSA):

.1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3, Design of Concrete Structures.

.5 International Concrete Repair Institute (ICRI):

.1 ICRI 310.2, Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data for each materials specified, including recommended application rates and methods of installation, and information on compatibility of different products and limitations.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit detailed cleaning and maintenance instructions for concrete densifier products and instruct the Owner in proper care and maintenance of specified floor finishes, including a complete list of floor care products that will be required for ongoing maintenance, in accordance with Section 01 78 00 – Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Work of this Section shall be executed by a company that has adequate equipment and skilled tradesmen capable of producing high-quality finished products and is known to have been responsible for satisfactory installations similar to that specified, during a period of at least the immediate past five years.

.2 High-quality control in the finished product to be measured in terms of surface flatness and levelness, uniformity in texture, smoothness, and appearance of hard steel troweled surfaces, precision in the construction of joints, and minimization of slab shrinkage, cracking, and edge curling.

.2 Co-operation:

.1 Ensure that concrete supplied for slabs contains no admixtures that would be incompatible with floor finishing materials.

1.8 PERFORMANCE REQUIREMENTS

.1 Floor flatness and levelness for slab-on-ground floor slabs:

.1 Conform to the following F-numbers requirements:

.1 Specified Overall Value: Ff 50 / Fl 35.

.2 Minimum Local Value: Ff 35 / Fl 25.

.2 Additional slab elevation requirements:

.1 Slab elevation change shall not exceed 6 mm over 610 mm (1/4" over 2'-0").

.2 Vertical step transitions shall not exceed 3 mm (120 mils or 0.120") adjacent to the expansion joint after expansion joint installation.

.3 Slab floor shall fall within approximately 19.05 mm (3/4") of the finished floor elevation.

1.9 SITE CONDITIONS

.1 Environmental Requirements:

.1 Ensure that adequate temporary heating is provided as required for cold weather work.

.2 Provide adequate moisture, sunshades, and wind barriers to prevent too rapid drying of concrete during hot weather.

.2 Protection:

.1 No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.

.2 Ensure that finished concrete floor areas are protected from abrasion from foot or wheeled traffic and damage caused by spillage of oil or other harmful materials.

.1 No motorized vehicles are allowed on slabs without proper protection for wheels and oil or hydraulic reservoirs to eliminate oil drips and avoid staining of the concrete.

.2 Do not park vehicles on the interior slab. If necessary to complete work, place impervious drop cloths under vehicles at all times.

.3 Do not use a pipe cutting machine on the inside floor slab.

.4 Do not place steel on interior slabs to avoid rust staining.

2 Products

2.1 MATERIALS

.1 Unless specified otherwise, materials shall meet specified requirements of Section 03 30 00 – Cast-in-Place Concrete.

.2 Curing Sheet: 2 mil polyethylene sheet conforming to CGSB 51-GP-51M or laminated waterproof kraft paper.

.3 Penetrating Concrete Sealer (SC-1): low VOC, vapour permeable, chemically reactive penetrating sealer: Provide:

.1 V-Seal Concrete Sealers: V-Seal 101.

.2 W. R. Meadows: INTRAGUARD

.3 Euclid Chemical Co.: EUCO-GUARD 350

.4 Liquid applied densifier, hardener and sealer (SC-3): Minimum 6% lithium silicate solid chemical floor hardener/sealer. Provide:

.1 Prosoco: Consolideck LS-CS,

.2 Dayton Superior: Pentra-Hard Densifier,

.3 Nox-Crete: Duro-Nox LSC, or

.4 SpecChem: LithSeal SC or Lite.

.5 Crack Repair Material: Two component, high penetration polyurethane for crack, spall, and surface repair of slab on grade.

.1 For cracks greater than 30-mil (0.030”):

.1 Metzger McGuire: Rapid Refloor.

.2 Roadware, Inc.: Roadware 10 Minute Concrete Mender.

.3 Sika Chemical Corp.: Sikaflex + Construction Sealant

.6 Concrete Bonding Agent:

.1 Epoxy based adhesive for bonding to concrete surfaces:

.1 Dayton Superior: Sure Bond J58.

.2 Euclid: Euco Epoxy #452 or #620.

.3 Sika Chemical Corp.: Sikadur 32 Hi-Mod.

.7 Patching Materials: Epoxy and cement repair mortar allowing thin cross sections:

.1 Dayton Superior: Thin Resurfacer.

.2 Euclid Chemical Co.: Thin Top Supreme or Concrete Top Supreme.

.3 Sika Chemical Corp.: Sikatop 121 Plus or 122 Plus.

.8 Evaporation Retardant: Acceptable products:

.1 Dayton Superior: AquaFilm.

.2 Euclid: Eucobar.

.3 Nox-Crete: Monofilm.

.4 Sonneborn: Confilm.

.5 SpecChem: Spec Film.

.9 Joint Sealant: Refer to Section 07 92 00 – Sealants.

3 Execution

3.1 EXAMINATION

.1 Before commencing work, ensure that surfaces are acceptable to receive and maintain concrete finishing and that specified installation will be achieved.

.2 Coordinate with Section 03 30 00 – Cast-in-Place Concrete for major repair of existing concrete and cutting of existing slab for new Work.

3.2 CURING CONCRETE

.1 Refer to Section 03 30 00 – Cast-in-Place Concrete for requirements for concrete temperature monitoring during curing.

.2 Begin curing immediately following placing and finishing in accordance with CSA A23.1:19 Clause 7.4 except as noted below. The rate of evaporation is dependent on the relative humidity, concrete temperature, and wind velocity. For the rate of evaporation of moisture from a concrete surface covered with water, see CSA A23.1 Appendix D Guidelines for curing and protection.

.3 Extend the curing and protection period until the concrete has reached the following strength

.1 levels for structural safety:

.1 Framed slabs and beams: minimum 75% of specified 28-day strength.

.2 Columns, walls, piers, and footings: minimum 70% of specified 28-day strength.

.4 Wet cure for 10 consecutive Days at a minimum temperature of 10°Celsius. This requirement supersedes the requirements of Table 20 Allowable Curing Regimes of CSA23.1:19.

.5 Establish the requirements of the specified finishes for concrete surfaces before applying the curing compound. Verify that the curing compound is compatible with the applied finishes.

.6 Do not use curing compounds on surfaces:

.1 Where bonded concrete topping will be applied.

.2 Where high temperature control requirements are in force.

.3 For potable water structures.

.7 Formed Surfaces (Walls and Columns)

.1 Wet cure as specified by pouring water between the formwork and the concrete surface, where possible.

.2 As an alternative, cure as specified above until the formwork is removed. Immediately after removal of the formwork, provide 24-hour saturation followed by the application of a curing compound in accordance with the manufacturer's printed instructions.

.8 Unformed Surfaces (Slabs)

.1 Cover with absorbent material kept continuously saturated as soon as the cement will not wash out or the finish will be damaged.

.2 As an alternative, wet cure for 24 hours then seal with two complete coats of curing compound applied in accordance with the manufacturer's instructions. Maintain the coating during the curing period.

.9 Bonded Concrete Toppings

.1 Wet cure for 10 consecutive Days if no bonding agent has been used.

.2 If a bonding agent has been used, employ curing methods for the concrete topping which will produce a cure equivalent to 10 Days of wet curing and which is in accordance with the bonding agent manufacturer's printed instructions.

.3 Protect and prevent damage to concrete topping floor finishes. Repair any damaged sections.

.4 Protect the topping from freezing for a minimum of 14 Days after placing.

3.3 FINISHING FLOORS AND SLABS

.1 Finish floors and slabs in accordance with ASTM E1155, CSA A23.1:19, and ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces; do not wet concrete surfaces.

3.4 INSTALLATION

.1 Concrete Finishing:

.2 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed.

.3 Bring surface to true grade by floating.

.4 Apply a three-trowel finish to designated monolithic slab surfaces:

.1 After floating, begin first trowel finish operation using power-driven trowel.

.2 Begin final troweling when surface produces ringing sound as trowel is moved over surface.

.3 Consolidate concrete surface by final hand and power trowel operation, free of trowel marks, uniform in texture and appearance.

.4 Do not overwork the final trowel operation.

.5 Do not burnish the slab surface.

.5 Liquid applied densifier, hardener and sealer:

.1 Follow the manufacturer's written instructions for the application of the liquid applied densifier, hardener and sealer.

.2 The manufacturer’s technical representative shall be present at the initial application to observe the work and provide technical assistance.

.3 It is critical that the dust or slurry from saw cutting of floor joints be thoroughly removed from the slab prior to application or alternatively, the densifier may be applied prior to saw cutting.

.6 Patching and floor Underlayment:

.1 Leak Prevention: Fill cracks and voids in the subfloor where leakage of slurry could occur using suitable quick-setting patch material or caulk, as recommended by the underlayment manufacturer.

.2 Prepare existing slab and rime substrate according to manufacturer’s recommendations.

.3 Installation shall not begin until the building is enclosed.

.4 Install sound attenuation mat where required on drawings, complete with isolation strips, before pouring floor underlayment.

.5 Mix underlayment in accordance with the manufacturer’s written instructions and test mix for slump using a 100mm (4") cylinder.

.6 Pour underlayment to the recommended thickness and immediately spread and screen to a smooth surface.

.7 Control Joints:

.1 As soon as the concrete surface is firm enough not to be torn or damaged by cutting, cut 5mm (3/16") wide control joints into the surface of the concrete with an abrasive blade power saw.

.2 Locate control joints on centre lines of columns, and at a maximum spacing of 6096mm (20') in both directions unless noted.

.3 Cut joints in slabs on grade 38mm (1-1/2") deep.

.4 Within four (4) weeks of cutting joints, fill them with joint sealant. Completely clean side joint surfaces of dirt, oil, grease, and similar contaminants. Mask

floor surfaces at joints while pouring. Prime side joint surfaces with compatible primer if surfaces are not completely dry.

.8 Cast-in all items as supplied by other Sections.

3.5 PROTECTION

.1 Keep traffic that would affect or disturb the curing procedures off of the finished surfaces for a minimum period of 7 Days.

.2 Protect all exposed concrete finishes against damage until acceptance of the Work by the Owner. Do not allow rain, sleet, or snow to increase the mixing water or damage the surface finish.

.3 Protect floors that are to receive architectural finishes against contamination by oil, paint, or other deleterious materials that may affect the finish.

.4 Protect any items set into floors from damage. Verify that the alignment is not disturbed.

3.6 TESTS AND INSPECTION

.1 Vapour Transmission Test: Conduct tests on new and existing concrete to show that no surface moisture exists prior to application of the specified special floor treatment, as follows:

.1 Place a polyethylene plastic sheet, a minimum of 1.2 m by 1.2 m in size and sealed along four sides with duct tape to prevent moisture transmission by evaporation, over the concrete floor area for 24 hours.

.2 An indication of moisture transmission will be apparent by the accumulation of moisture on the enclosed surface of a polyethylene plastic sheet.

.3 Do not apply a concrete bonding agent until the test results indicate that moisture is not being transmitted from the concrete surface.

3.7 FIELD QUALITY CONTROL

.1 Measure the floor slab flatness and levelness, as applicable, in accordance with CSA A23.1:19, Clause 7.5.1.2 Straightedge Method.

3.8 PATCHING AND REFINISHING

.1 Patch and refinish defective surfaces to match surrounding areas with no discernible variation in appearance.

3.9 CONCRETE FINISHING SCHEDULE

.1 Refer to project drawings for concrete finishing requirements.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 13 – Masonry Mortaring and Grouting

.2 Section 04 05 19 – Masonry Anchorage and Reinforcing

.3 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-A165 Series-14, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A371-14, Masonry Construction for Buildings.

.2 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.2 Submit copies of WHMIS SDS in accordance with Section 01 70 12 - Safety Requirements.

.3 Shop Drawings:

.1 Submit drawings showing masonry sizes, special masonry shapes, installation patterns, control joints, details of reinforcing bars (including wall elevations) and locations of weep holes and vents.

.4 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Material and Equipment and 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 Store materials off ground or in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect material packages from nicks, scratches, and blemishes.

.3 Keep materials dry until use except where wetting of bricks is specified.

.4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

.5 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

.1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.

.2 Weather Requirements: to CAN/CSA-A371.

.3 Cold weather requirements:

.1 To CAN/CSA-A371 with following requirements.

.1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.

.2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.

.3 Maintain temperature of masonry above 0 degrees C for minimum of 7 days, after mortar is installed.

.4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.

.2 Hot weather requirements:

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

.3 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

2 Products

2.1 MATERIALS

.1 Masonry materials are specified elsewhere in related Sections:

.1 Section 04 05 13 – Masonry Mortaring and Grouting

.2 Section 04 05 19 – Masonry Anchorage and Reinforcing

.3 Section 04 22 00 – Concrete Unit Masonry

3 Execution

3.1 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.1 Co-ordinate with Section 01 71 00 - Examination and Preparation.

.2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Consultant.

.3 Verification of Conditions:

.1 Verify that:

.1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete block.

.2 Site conditions are acceptable and are ready to receive work.

.3 Built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

.1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

.2 Establish and protect lines, levels, and coursing.

.3 Protect adjacent materials from damage and disfiguration.

3.3 INSTALLATION

.1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.4 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CAN/CSA-A165, in exposed masonry and replace with undamaged units.

.2 Jointing:

.1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.

.2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.

.3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

.3 Cutting:

.1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

.4 Building-In:

.1 Build in items required built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Wetting of bricks:

.4 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1000 mm2: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.

.5 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

.6 Support of loads:

.6 Use concrete fill as specified on drawings.

.7 Use grout to CAN/CSA-A179 where grout is used instead of solid units.

.8 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.

.7 Provision for movement:

.1 Leave 3 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers, with provision for vertical movement.

.8 Loose steel lintels:

.1 Install loose steel lintels. Center over opening width.

.9 Control joints:

.1 Construct continuous control joints as indicated.

.10 Movement joints:

.1 Build-in continuous movement joints as indicated.

.11 Interface with other work:

.1 Cut openings in existing work as indicated.

.2 Openings in walls: reviewed by Consultant,

.3 Make good existing work. Use materials to match existing.

3.5 SITE TOLERANCES

.1 Tolerances in notes to CAN/CSA-A371 apply.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction Demolition Waste **MANAGEMENT**.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Temporary Bracing:

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

.1 Moisture Protection:

.1 Keep masonry dry using waterproof, non staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.

.2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

.3 Air Temperature Protection: protect completed masonry as recommended in 1.9, SITE CONDITIONS.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 05 19 – Masonry Anchorage and Reinforcing

.3 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A371-14, Masonry Construction for Buildings.

.4 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

.3 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.2 Submit copies of WHMIS SDS in accordance with Section 01 70 12 - Safety Requirements. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

.3 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 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 Store materials off ground or in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry mortar and grout packages from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ambient Conditions: maintain materials and surrounding air temperature to:

.1 Minimum 10 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Weather Requirements: CAN/CSA-A371.

2 Products

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Cement:

.1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10) gray colour.

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type N.

.3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type N.

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.4 Packaged Dry Combined Materials for mortar: to CAN/CSA-A179, Type N, using gray colour cement.

.3 Aggregate: supplied by one supplier.

.1 Fine Aggregate: to CAN/CSA-A179

.2 Course Aggregate: to CAN/CSA-A179

.4 Water: clean and potable.

.5 Lime:

.1 Hydrated Lime: to CAN/CSA-A179, Type S.

.6 Bonding Agent: epoxy type.

.7 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 MORTAR MIXING

.1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to within 1% accuracy.

.2 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.

.3 Maintain sand uniformly damp immediately before mixing process.

.4 SPEC NOTE: Carbon black pigment is not recommended for permanent use in climates with significant precipitation and freeze-thaw cycles. Use of black iron oxide is recommended if a permanent colouring effect is desired.

.5 Using anti-freeze compounds including calcium chloride or chloride based compounds is prohibited.

.6 Adding air entraining admixture to mortar mix is prohibited.

.7 Use a batch type mixer in accordance with CAN/CSA-A179.

.8 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

.9 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.

.10 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 5 degrees C.

2.3 GROUT MIXES

.1 Bond Beams: Where fill material is not specified on drawings, grout mix to 12.5 MPa strength at 28 days; 200-250 mm slump mixed in accordance with CAN/CSA-A179.

.2 Lintels: Where fill material is not specified on drawings, grout mix to 12.5 MPa strength at 28 days; 200-250 mm slump mixed in accordance with CAN/CSA-A179.

.3 Grout: Minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump: CAN/CSA-A179.

2.4 GROUT MIXING

.1 Mix batched and delivered grout in accordance with CSA A23.1/A23.2 transit mixed.

.2 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA-A179.

.3 Add admixtures in accordance with manufacturer's instructions; mix uniformly.

.4 Using calcium chloride or chloride based admixtures is prohibited.

2.5 MIX TESTS

.1 Testing Mortar Mix:

.1 Test mortar to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, for mortar based on property specification. Test prior to construction for:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.7 Splitting tensile strength.

.2 Testing Grout Mix:

.1 Test grout to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, for grout based on property specification. Test prior to construction for:

.1 Compressive strength.

.2 Sand/cement ratio.

.3 Water content and water/cement ratio.

.4 Slump.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.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 PREPARATION

.1 Apply bonding agent to existing concrete surfaces.

.2 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.

.2 Apply parging in uniform coating not less than 10 mm thick, where indicated.

3.4 MIXING

.1 Pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand pre-approved by Consultant.

.2 Clean mixing boards and mechanical mixing machine between batches.

.3 Mortar: weaker than units it is binding.

.4 Contractor to appoint one individual to mix mortar, for duration of project. In event that this individual is changed, mortar mixing must cease until new individual is trained, and mortar mix is tested.

3.5 MORTAR PLACEMENT

.1 Install mortar to manufacturer's instructions.

.2 Install mortar to requirements of CAN/CSA-A179.

.3 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

.1 Install grout in accordance with manufacturer's instructions.

.2 Install grout in accordance with CAN/CSA-A179.

.3 Work grout into masonry cores and cavities to eliminate voids.

.4 Installing grout in lifts greater than 400 mm, without consolidating grout by rodding is prohibited.

.5 Displacing reinforcement while placing grout is prohibited.

3.7 FIELD QUALITY CONTROL

.1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Test and evaluate mortar prior to construction and in accordance with CAN/CSA-A179.

.2 Test and evaluate grout prior to construction and to CAN/CSA-A179; test in conjunction with masonry unit sections specified.

.2 Manufacturer's Field Services: in accordance with Section 04 05 00 - Common Work Results for Masonry.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction Demolition Waste Management.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 05 13 – Masonry Mortaring and Grouting

.3 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A167-15, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.4 ASTM A580/A580M-16, Standard Specification for Stainless Steel Wire.

.5 ASTM A641/A641M-(R2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.6 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.7 ASTM A1022 16B, Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement.

.2 CSA Group (CSA)

.1 CSA A23.1/A23.2-14 (R2015), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A370-14, Connectors for Masonry.

.4 CAN/CSA-A371-14, Masonry Construction for Buildings.

.5 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.

.6 CSA S304-14(R2015), Design of Masonry Structures.

.7 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Reinforcing Steel Institute of Canada (RSIC)

.1 Reinforcing Steel Manual of Standard Practice, 2004.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.2 Submit copies of WHMIS SDS.

.3 Shop Drawings:

.1 Submit drawings detailing bar bending details, anchorage details lists and placement drawings.

.2 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.4 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 SITE MEASUREMENTS

.1 Make site measurements necessary for proper fit of members.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect anchorage and reinforcing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 Bar reinforcement: Steel to CAN/CSA-A371 and CSA G30.18, Grade 400R.

.2 Connectors: to CAN/CSA-A370 and CSA S304.1.

.3 Fasteners: installed post-construction:

.1 Bolts and Screws: size and type to suit application, locate where indicated.

.2 Nails: case-hardened cut or spiral nails, size and type to suit fastening application.

.3 Powder-Driven Fasteners: pin styles and lengths to suit fastening application in accordance with manufacturers use, load and hold recommendations.

.4 Adhesives: epoxies, mastics and contact cements for fastening applications, use in accordance with manufacturers' recommendations.

.4 Ties: hot dip galvanized to CAN/CSA-A370 Table 5.2 steel finish.

.1 Corrugated to: CAN/CSA-A370.

.2 Unit ties, to CAN/CSA-A370: rectangular or Z style, fabricated form wire stainless steel, size to suit application.

.3 Adjustable Unit Ties: to CAN/CSA-A370: proprietary type ties, type, style and size to suit application in accordance with manufacturer's recommendations.

.4 Joint Reinforcement Ties: CSA A371 with corrosion protection to CSA S304 and CSA A370:

.1 Single Wythe Joint Reinforcement: ladder

.2 Multiple Wythe Joint Reinforcement: ladder

.5 Anchors: to CAN/CSA-A370:

.1 Conventional Anchors: type steel bolts with bent bar anchors, shape J, sized to suit application.

.2 Wedge Anchors: expansion anchors type wedge and bolt, sized to suit application.

.3 Spiral Anchors: 8 mm stainless steel spiral anchors to Grade 304.

.4 Anchor Bolts: steel galvanized to CAN/CSA-A370 Table 5.2.

.6 Conventional Bolts:

.1 Bolts: to ASTM A36, bar stock shop threaded, straight bolts with square or hex-headed nuts, bent bar anchors, J shaped.

.2 Through bolt rods: to ASTM A307 threaded rod or threaded ASTM A36 bar stock.

.7 Adhesive Anchors: proprietary systems, pre-mixed, self-contained system with double glass vial system to contain epoxy, consisting of resin, hardener and aggregate measure and mix system where epoxy materials are hand-measured and mixed in accordance with manufacturers' written instructions.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CAN/CSA-A370.

.3 Obtain Consultant approval for locations of reinforcement splices other than shown on placing drawings.

.4 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis.

.2 Upon request, inform Consultant of proposed source of supplied material.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage and reinforcing materials installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Supply and install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371, CSA A23.1/A23.2 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing concrete, mortar or grout, obtain Consultant approval of placement of reinforcement and connectors. Supply and install additional reinforcement to masonry as indicated.

3.3 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA S304.1, CAN/CSA-A371 and as indicated.

.2 Tie masonry veneer to backing in accordance with National Building Code of Canada (NBC), CSA S304.1, CAN/CSA-A371 and as indicated.

.3 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CAN/CSA-A370, CAN/CSA-A371 and manufacturer's instructions.

.1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371 and as indicated.

.2 Install horizontal joint reinforcement 400 mm on centre.

.3 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.

.4 Place joint reinforcement continuous in first and second joint below top of walls.

.5 Lap joint reinforcement ends minimum 150 mm.

.6 Connect stack bonded unit joint corners and intersections with strap anchors 400 mm on centre.

3.4 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry beams, masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.1, CAN/CSA-A371, and CAN/CSA-A179.

.3 Support and position reinforcing bars in accordance with CAN/CSA-A371.

3.5 GROUTING

.1 Grout masonry in accordance with CSA S304.1, CAN/CSA-A371 and CAN/CSA-A179 and as indicated.

3.6 ANCHORS

.1 Supply and install metal anchors in accordance with CAN/CSA-A370 and CAN/CSA-A371 as indicated.

3.7 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.8 MOVEMENT JOINTS

.1 Reinforcement not continuous across movement joints unless otherwise indicated.

3.9 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.

.2 When field bending authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars and connectors with cracks or splits.

3.10 FIELD QUALITY CONTROL

.1 Site inspections in accordance with Section 04 05 00 - Common Work Results for Masonry.

.2 Obtain Consultant approval of placement of reinforcement and connectors, prior to placing mortar, grout or concrete.

3.11 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.12 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction Demolition Waste Management.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes supply and installation of unit masonry assemblies consisting of the following:

- .1 Concrete Masonry Units (CMU).
- .2 Masonry accessories.
- .3 Site quality control.

.2 Section 04 05 00 – Common Work Results for Masonry

.3 Section 04 05 13 – Masonry Mortar and Grouting

.4 Section 04 05 19 – Masonry Anchorage and Reinforcing

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standard.

.2 American Concrete Institute: (ACI):

- .1 ACI 530.1/ASCE 6/TMS 602, Commentary on Specification for Masonry Structures

.3 Brick Institute Association (BIA)

- .1 BIA Technical Notes 20, Cleaning Brickwork
- .2 BIA Technical Notes 23A - Efflorescence, Causes and Prevention

.4 Canadian Standards Association (CSA):

- .1 CSA A165, CSA Standards on Concrete Masonry Units
- .2 CSA A179, Mortar and Grout for Unit Masonry
- .3 CSA A370, Connectors for Masonry
- .4 CAN/CSA A371, Masonry Construction for Buildings
- .5 CSA S304.1, Design of Masonry Structures
- .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction

.5 American Society for Testing of Materials (ASTM):

- .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .2 ASTM A153/A153M, Standard Specification for Zinc Coating (HotDip) on Iron and Steel Hardware
- .3 ASTM A496/A496M, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- .4 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts
- .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.6 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

.7 ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

.8 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes

.9 ASTM C270, Standard Specification for Mortar for Unit Masonry

.10 ASTM C494, Standard Specification for Chemical Admixtures for Concrete

.11 ASTM C568/C568, Standard Specification for Limestone Dimension Stone

.12 ASTM E488/E488M, Standard Test Methods for Strength of Anchors in Concrete Elements

.13 ASTM E514/E514M, Standard Test Method for Water Penetration and Leakage Through Masonry

.14 ASTM E2556/E2556M, Standard Specification for Vapour Permeable Flexible Sheet Water Resistive Barriers Intended for Mechanical Attachment

.15 ASTM F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

.16 ASTM F594, Standard Specification for Stainless Steel Nuts

.6 Canadian Concrete Masonry Producer Association (CCMPA):

.1 CCMPA Metric Technical Manual

.7 Underwriters Laboratories of Canada (ULC):

.1 ULC List of Equipment and Materials for Fire Rated Construction

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this Section.

.2 Coordinate the masonry work with anchor requirements at framed openings.

.3 Coordinate the masonry work with air barrier installation to achieve continuous monolithic air barrier.

1.5 SUBMITTALS

.1 Samples: Submit samples of the following; stone tile panel, concrete block, mortar, masonry reinforcement, ties and anchors, damp course/thru-wall flashing and adhesive, metal drip flashing, mortar dropping control device and weepholes for Consultant's approval before commencing work of this section.

.2 Shop Drawings: Submit shop drawings indicating the following:

.1 Indicate sizes, profiles, coursing, and locations of special shapes for concrete masonry units and stone masonry cladding.

.2 Indicate sizes, profiles, and locations of each stone trim unit required.

.3 Detail corner units, end dam units, and other special applications for fabricated flashings.

.3 Samples for Verification: Submit samples for verification for each type and colour of the following:

.1 Decorative stone masonry cladding units, in the form of small-scale units.

.4 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:

.1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of the Building Code, Division B, Part 3 and Appendix D.

.2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed.

.3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.

.5 Certificates: Submit statements of material properties indicating compliance with specified requirements for each type and size of the following:

.1 Masonry Units:

.1 Include material test reports substantiating compliance with requirements.

.2 Include ULC Listings for fire resistance rated materials and construction equivalent to assemblies with indicated on drawings indicating fire resistance ratings.

.2 Cementitious Materials:

.1 Include brand, type, and name of manufacturer for site mixed mortar materials.

.2 Include description of type and proportions of ingredients for pre-blended, dry mortar mixes.

.3 Include description of type and proportions of ingredients for grout mixes.

.3 Accessories:

.1 Reinforcing bars

.2 Joint reinforcement

.3 Anchors, ties, and metal accessories

.4 Site Quality Control Submissions: Submit detailed description of methods, materials, and equipment used in accordance with cold or hot weather requirements; and proposed unit masonry cleaning techniques.

1.6 SITE CONDITIONS

.1 Protection of Masonry: Protect masonry and other work from marking and other damage and as follows:

.1 Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work during construction until permanent flashings and membranes are completed.

.2 Cover partially completed masonry when construction is not in progress to prevent wetting of inside wythes of construction and contribution to efflorescence.

.3 Extend cover a minimum of 610 mm (24”) down both sides and hold cover securely in place.

.4 Secure cover a minimum of 610 mm (24”) down face next to un-constructed wythe and hold cover in place where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes.

.5 Provide adequate bracing for masonry during construction and until permanent lateral supports are in place.

.6 Do not apply uniform floor or roof loads for a minimum of 12 hours and concentrated loads for a minimum of 3 days after building masonry walls or columns.

.2 Cold Weather Protection:

.1 Keep masonry materials completely free from ice and frost. Use approved smokeless heaters. Do not use scorched sand. Do not use salts, admixtures or antifreezes.

.3 Conform to the following construction requirements:

AIR TEMPERATURE	HEATING OF MATERIALS	PROTECTION
Above 5 deg C	Normal masonry procedures	Cover walls and materials
Below 5 deg C	Heating mixing water. Maintain mortar temperatures between 5 deg C and 50 deg C until placed	Cover walls and materials to prevent wetting and freezing.
Below 0 deg C	In addition to above heat sand. Thaw frozen sand and frozen wet masonry units before use.	With wind velocities over 35 km/h provide windbreaks during the workday and cover walls and materials at the end of each workday to prevent wetting and freezing. Maintain masonry above 0 deg C by using auxiliary heat or insulated blankets for 16 hours after laying masonry units.
Below -6 deg C	In addition to above heat dry masonry units to -6 deg C	Provide enclosure and supply sufficient heat to maintain masonry enclosure above 0 deg C for 24 hours after laying masonry units.

.4 Hot Weather Requirements

.1 Comply with hot weather construction requirements contained in reviewed submittals.

.2 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.3 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

1.7 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Delivery and Acceptance Requirements: Deliver pre-blended, dry mortar mix in moisture resistant containers designed for lifting and emptying into dispensing silo; store dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

.2 Storage and Handling Requirements: Store masonry units on elevated platforms in a dry location and as follows:

.1 Stack materials on floors of building so that structural design loads are not exceeded; coordinate with Consultant.

.2 Cover tops and sides of stacks with waterproof sheeting securely tied to pallets if units are not stored in an enclosed location; do not install masonry units that become wet until they are dry.

.3 Store cementitious materials on elevated platforms, under cover, and in a dry location; do not use cementitious materials that have become wet or damp.

.4 Store aggregates where grading and other required characteristics can be maintained; store to prevent contamination by substances deleterious to performance and appearance.

.5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

2 Products

2.1 CONCRETE MASONRY UNITS

.1 Architectural Concrete Masonry Units: Manufactured in accordance with CAN/CSA A165, and as follows:

.1 Classification: [H/15/A/M] [and] [S/15/A/M]

.2 Size: Modular [metric] [imperial] to sizes indicated on Drawings.

.3 Type [CM1]:

.1 Configuration: [Full Block] [Half Block] [Veneer Block]

.2 Decorative Face Treatment: [Natural Block Face] [Split Face] [Polished Face[, with beveled edges]] [Chiseled Face, [top and bottom] [top, bottom and sides]] [Hammered Face] [Saw Cut Face] [Stone Textured Face], based on [Manufacturer's name and product name]

.3 Profile: [Ledge] [2 Rib] [4 Rib] [6 Rib] [Single Score] [Three Score]

.4 Colour: [List Colour Designation]

.5 Basis of Design Materials: [List Model and Manufacturers Name][Schouldice Designer Stone]

.4 Special shapes:

.1 Provide [square] [bull nosed] [and] [half high] units for exposed corners.

.2 Provide purpose made shapes for lintels and bond beams.

.3 Provide additional special shapes required for project.

.4 Manufacture special shapes at same time and with the same batch as architectural concrete block to be used.

.2 Standard concrete blocks shall be autoclave or bubble cure process, high pressure steam cured, modular, conforming to CSA A165, with lineal shrinkage and moisture movement not to exceed 0.035% and shall be as follows;

.1 Classification: H/20/C/M, 75% solid for all locations where structural members bear on concrete block.

.2 H/20/C/M, for all other block work.

.3 Size: Modular imperial to sizes indicated on Drawings.

.4 Special shapes:

.1 Provide square units for exposed corners.

.2 Provide purpose made shapes for lintels and bond beams.

.3 Provide additional special shapes required for project.

.4 Manufacture special shapes at same time and with the same batch as standard concrete block to be used.

.3 Use lightweight concrete masonry units, for non-load bearing interior walls, unless indicated otherwise: H/15/D/M for hollow units and SS/15/D/M for solid units.

.4 Fire Resistant Concrete Masonry Units:

.1 CAN/CSA-A165 Series, same classification as non-rated block units except aggregate used in units and equivalent thickness of units to comply with applicable Code for fire-resistance ratings indicated. For fire rated walls requiring a fire-resistance rating of 3 hours or greater, use ULC certified units.

.5 Size: Modular to sizes indicated on Drawings.

.1 Where concrete block walls are required as fire separations or barriers, they shall conform to the National Building Code. With respect to equivalent thickness and type of concrete. Consult with Consultant for locations and special conditions.

.6 Exposed block shall all be made by one manufacturer and shall be uniform in colour, shade and texture.

2.2 MORTAR MATERIALS

.1 Mortar materials shall conform to CSA A179.

.2 Water: Potable (clean, exempt of ice, oils, acid, alkalis, organic matter, sediments or any other harmful matter). CSA A179.

.3 Aggregate:

.1 CSA A179.

.2 Use same brands of materials and source of aggregate for entire project.

.3 Use washed aggregate consisting of natural sand or crushed stone for mortar that is exposed to view.

.4 Cement: Normal portland, in accordance with CSA A3000, Type GU.

.5 Grout: In accordance with CSA A179, Table 3.

.6 Hydrated Lime: ASTM C207, Type S.

.7 Cold Weather Admixture:

.1 Non-chloride, non-corrosive, accelerating admixture in accordance with CSA A179 and ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

.2 Acceptable Materials:

.1 Morset by GCP Applied Technologies

.2 BASF, Trimix-NCA

2.3 MORTAR MIXES

.1 Mixing:

.1 Prepare and mix mortar materials under strict supervision and in small batches for immediate use only. Mix proprietary mortars in strict accordance with CSA A179. Do not use re-tempered mortars for coloured mortars.

.2 For Masonry Below Grade and In Contact With Earth:

.1 Use premixed silo or bagged Type 'S' masonry cement mortar having minimum compressive strength of 8.5 MPa at 28 days, jobsite tested.

.3 For Exterior Wythe of Cavity/Composite Walls (non-load-bearing, above grade):

.1 Use Type 'N', 1:1:6 pre-mixed, pre-coloured, Portland cement/lime/sand mortar, Betomix Plus by Daubois Inc., or by Maxi-Mix silo. Use non-staining "white" cement where required to achieve colour as selected later by the Consultant.

.4 Interior Reinforced or Non-Reinforced Block Walls:

.1 Use Type 'S', premixed Bloc Mix by Daubios Inc., or approved equal by Maxi-Mix.

.5 For All Other Masonry:

.1 Use Type 'N', premixed silo or bagged masonry mortar having a minimum compressive strength of 3.5 MPa at 28 days, jobsite tested as per property specification, Table 6, CSA A179.

2.4 MASONRY REINFORCEMENT, TIES AND ANCHORS

.1 Masonry Joint Reinforcement: In accordance with to CSA A371 and ASTM A496/A496M, with corrosion protection in accordance with CSA S304.1 and CSA A370, and as follows:

.1 Interior Walls: Hot dip galvanized, carbon steel.

.2 Exterior Walls: Stainless steel.

.3 Lengths: A minimum of 3050 mm (10’) with prefabricated corner and tee units.

.2 Connectors: In accordance with to CSA A370 and CSA S304.1 with hot dip galvanized finish.

.3 Single Wythe Masonry Joint Reinforcement: Either ladder or truss type with single pair of side rods.

.4 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:

.1 Deflection: Maximum 1.6 mm (1/16”) including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.

.2 Positive restraint at position of maximum adjustment.

.3 Free play of multi-component ties maximum 0.8 mm (1/32”) when assembled in all possible configurations.

.4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.

.5 Lateral Partition Supports (Top of Wall Anchors):

.1 Angle Support: Fabricated from 3 mm (1/8”) core metal thickness angled steel plate having 75 mm (3”) long legs fastened to deck structure to allow vertical movement of masonry assembly; hot dip galvanized; coordinate with Section 07 84 00 – Firestopping and Smoke seals for firestopping insulation and smoke seals.

.2 Plate Support: Fabricated from 3 mm (1/8") core metal thickness stainless steel plate with 9.5 mm (3/8") diameter metal 150 mm (6") long welded to plate having closed end plastic tube fitted over rod that allows rod to move in and out of tube.

.3 Anchor Bolts: Where required provide Headed or L-shaped steel bolts in accordance with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized in accordance with ASTM A153/A153M, Class C.

.4 Post Installed Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete when tested in accordance with ASTM E488/E488M conducted by a qualified independent testing agency, and as follows:

.1 Indoor Locations: Carbon-steel components zinc-plated in accordance with ASTM B633, Class Fe/Zn 5.

.2 Outdoor and High Humidity Locations: Alloy Group 1 or 2 stainless steel bolts complying with ASTM F593 and nuts complying with ASTM F594.

.3 Fastening into Solid Concrete or Solidly Grouted Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts into new or existing concrete or grout. Basis-of-Design Materials: Hilti Inc., HIT HY150 System, no Substitutions Accepted.

.4 Fastening Trough Hollow Wall Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts, with cylindrical mesh screen tube into new or existing masonry cavity wall. Basis-of-Design Materials: Hilti Inc., HIT HY20 System, no Substitutions Accepted.

.6 Galvanizing for Masonry Reinforcement, Ties and Anchors:

.1 Hot Dip Hardware and Bolts: In accordance with ASTM A153/A153M, Class B-2 regardless of location.

.2 Hot Dip Sheet Steel: In accordance with ASTM A653/A653M, Coating Designation Z600, regardless of location.

.3 Structural Shapes and Pipes: In accordance with ASTM A123/A123, Grade 85, regardless of location.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

.1 Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation 2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

.1 Products: Subject to compliance with the requirements of this Section, provide:

.1 RS Series – Rubber Control Joints by Hohmann & Barnard, Inc.

.2 Packing Insulation: Loose, mineral wool insulation, 16 kg/m^3 (1.0 lbs./cu.ft.) density, and conforming to CAN/CGSB-51.11, as indicated in Section 07 21 16 – Blanket Insulation and Vapour Barrier.

.3 Firestopping: As specified under Section 07 84 00 – Firestopping and Smoke seals.

.4 Sealants: As specified under Section 07 92 00 – Sealants.

.5 Support Angle:

.1 Hot dip galvanized 458 g/m5/side in accordance with CSA A370 and ASTM A153/A153M.

.6 Fasteners: Galvanized fasteners meeting the requirements of ASTM A325, and as recommended by manufacturer.

.7 Joint Filler:

.1 Compressible Filler: Pre-moulded filler strips in accordance with ASTM D1056, Grade 2A1; compressible up to 35%; of width and thickness indicated; formulated from neoprene, urethane or PVC.

.8 Bond Breaker Strips: #15 asphalt saturated, organic roofing felt in accordance with CSA A123.3.

3 Execution

3.1 EXAMINATION

.1 Verify that field conditions are acceptable and are ready to receive work.

.2 Verify items provided by other sections of work are properly sized and located.

.3 Verify that built-in items are in proper location, and ready for roughing into masonry work.

.4 Verify walls including steel connections n walls to be grouted have been inspected by structural engineer before grouting.

3.2 PREPARATION

.1 Direct and coordinate placement of metal anchors supplied to other Sections.

.2 Provide temporary bracing and shoring during installation of masonry work. Maintain in place until building structure provides permanent bracing.

.3 Protect materials and adjacent construction mortar droppings and damage during construction.

.4 Plug grouting clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 COURSING

.1 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.2 Establish lines, levels, and coursing indicated. Protect from displacement.

.3 Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

.4 Concrete Masonry Units:

.1 Bond: Running; stack bond for walls indicated with vertical bar reinforcing.

.2 Coursing: One unit and one mortar joint to equal 200 mm (8”).

.3 Mortar Joints: Concave where exposed or where paint or other finish coating is indicated; flush for concealed joints. Cut mortar joints flush where resilient base, wall tile, parging, air barrier or insulation is scheduled.

3.4 PLACING AND BONDING

.1 Lay hollow masonry units with face shell bedding on head and bed joints.

.2 Reinforced Masonry: Lay masonry units with core cells vertically aligned clear of mortar and unobstructed. Place mortar in masonry unit bed joints back 6 mm (1/4”) from edge of unit grout spaces, bevel back and upward.

.3 Where indicated, provide special shape units.

.4 Exposed Faces: Lay face work from face side with exposed face flush.

.5 Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

.6 Remove excess mortar as work progresses.

.7 Interlock intersections and external corners of walls with running bond.

.8 Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

.9 Perform job site cutting of masonry units with power-driven abrasive discs to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Allow 3 mm (1/8") clearance around items penetrating or built into walls.

.10 Isolate masonry from vertical structural framing members with a control joint.

.11 Isolate top joint of masonry from horizontal structural framing members and slabs or decks with compressible joint filler. Finish resulting joint with Sealant.

.12 Fill masonry cores with grout at:

.1 Ends of walls, both free and abutting other work.

.2 Jambs of openings, minimum 300 mm (12") from jamb face.

.3 Courses under plates and lintel requiring bearing.

.4 Attachment devices for fixtures and built-in items.

.5 Courses at tops of fire rated walls.

.6 Blocks of parapet walls, and in accordance with CSA-A371, Appendix G1.

.7 Anchors set in block cells.

.8 Install building paper below voids to be filled with grout; keep paper 25 mm (1") back from face of units.

3.5 CONTROL AND EXPANSION JOINTS

.1 General: Install control and expansion joint materials in unit masonry where indicated and not to exceed 6 meters (20') on center and 3 meters (10') from corners. Build-in related items as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

.2 Form control joints in concrete masonry as follows:

.1 Install preformed control-joint gaskets designed to fit standard sash block.

.2 Keep head joints free and clear of mortar for application of sealant.

3.6 PROVISION FOR MOVEMENT

.1 Leave space of dimension indicated between top of non-loadbearing wall and structural elements. Do not use wedges.

3.7 REINFORCEMENT AND ANCHORAGE

.1 Install reinforcement and anchorage to CSA-A370, CSA-A371 and CSA-S304.1 and as indicated.

.2 Install masonry joint reinforcement as indicated. Where not indicated provide as follows:

.1 Install horizontal joint reinforcement 400 mm (16") on centre. For stack bond, place joint reinforcement at every course.

.2 Place reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm (16") each side of opening.

.3 Place reinforcement continuous in first and second joint below top of walls.

.4 Lap joint reinforcement ends minimum 150 mm (6").

.3 Bar Reinforcing Steel:

.1 Secure reinforcing steel in place. Provide bar sizes, laps and spacings as indicated. Maintain position within 13 mm (1/2") of dimensioned position.

.2 Unless otherwise indicated locate vertical reinforcing on centerline of units.

.3 Unless otherwise indicated, reinforce stack-bonded unit joint corners and intersections with strap anchors 400 mm (16") on centre.

.4 Secure reinforcing steel in place. Inspect steel connections before grouting.

.5 Provide cleanout openings at bottom of cores containing reinforcement.

.6 Fill cells containing reinforcement and anchor bolts solidly with grout.

.4 Anchorage:

.1 Provide lateral supports for masonry walls and partitions as required by applicable codes, perpendicular to wall faces and either horizontally or vertically to wall panel edges.

.2 Where lateral support at tops of walls is required, provide anchors or clip angles installed at spacings not exceeding 10 times the wall thickness, unless otherwise indicated.

.3 Where lateral support at sides of walls is required, provide anchors or clip angles installed at spacings not exceeding 4 times the wall thickness, unless otherwise indicated.

3.8 LINTELS

.1 Install steel lintels where indicated.

.2 Provide masonry lintels where shown and where openings of more than 610 mm (24") are shown without structural steel or other supporting lintels.

.3 Provide minimum bearing of 200 mm (8") at each jamb unless otherwise indicated.

3.9 LATERAL SUPPORT AND ANCHORAGE

.1 Unless otherwise indicated, attach strap anchors to building structural members abutting ends of walls. Embed in every second block joint.

.2 Provide other lateral support and anchorage as indicated.

3.10 GROUTING REINFORCED MASONRY

.1 Permit mortar to cure 7 days before placing grout.

.2 Unless otherwise indicated, reinforce masonry unit cores with reinforcing bars and grout as follows:

.1 Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement as indicated.

.2 Wet masonry unit surfaces, in contact with grout just prior to grout placement, when required, to reduce moisture suction from grout.

.3 Grout spaces less than 50 mm (2") in width with Fine grout using low lift grouting techniques. Grout spaces 50 mm (2") or greater in width with Coarse grout using high or low lift grouting techniques. Completely fill spaces of stack bonded masonry; attain minimum 50 percent grout filling of spaces in running bond masonry.

.4 When grouting is stopped for more than one hour, terminate grout 38 mm below top of upper masonry unit to form a positive key for subsequent grout placement.

.3 Low Lift Grouting: Place first lift of grout to a height of 400 mm (16”) to three masonry unit courses and rod for grout consolidation. Place subsequent lifts in 200 mm (8”) increments and rod for grout consolidation.

.4 High Lift Grouting:

.1 Provide cleanout opening no less than 100 mm (4”) high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.

.2 Clean out masonry cells with high pressure water spray. Permit complete water drainage.

.3 Request inspection of cells. Allow 3 days advance notice of inspection.

.4 After cleaning and cell inspection, seal openings with masonry units.

.5 Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

.6 Limit grout lift to 1500 mm (5’) and mechanically vibrate. Wait 45 minutes before placing next lift.

3.11 CONTROL JOINTS

.1 Provide continuous control joints as indicated.

.2 Do not continue horizontal joint reinforcement through control joints, unless otherwise indicated.

.3 Break vertical mortar bond with control joint filler, full depth of unit. Fill adjacent core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

.4 Size control joint as specified in Division 07 Section Sealants, for sealant performance.

.5 Where joint locations are not indicated, space joints 6 m (20’) on centre, and one adjacent to corner at each change of direction.

3.12 BUILT-IN WORK

.1 As work progresses, install built-in items to be built into the work and furnished by other sections.

.2 Install built-in items plumb and level.

.3 Build chases; cutting not permitted. When openings require cutting after walls are in place, saw cut only; breaking of block not permitted.

.4 Where masonry encloses conduit or piping, place to required level to permit inspection and testing. Cover items when directed.

.5 Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill hollow metal door frame voids solid with grout or insulation as indicated.

.6 Do not build in organic materials subject to deterioration.

3.13 ERECTION TOLERANCES

.1 Maximum Variation from Plane of Wall: 6 mm/3 m (1/4” per 10’) and 13 mm/6 m (1/2” per 20’) or more; 3 mm/3m (1/8” per 10’) for walls to receive thin-set tile.

.2 Maximum Variation from Plumb: 6 mm (1/4”) per story non-cumulative; 13 mm (1/2”) in two stories or more.

.3 Maximum Variation from Level Coursing: 3 mm/m (1/8” per 36”) and 6 mm/3 m (1/4” per 120”).

3.14 CUTTING AND FITTING

.1 Cut and fit neatly for conduit, sleeves, recessed or built-in objects. Coordinate with other sections of work to provide correct size, shape, and location.

.2 Make cuts straight, clean and free of uneven edges.

.3 Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 SITE QUALITY CONTROL

.1 Inspections:

.1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located, to perform inspections.

.2 Perform timely and regular inspections.

.3 Verify installation conforms to applicable building Code.

.4 Prepare and submit inspection forms required by applicable building code.

.2 Testing:

.1 Owner will engage qualified independent testing agency to inspect, and test engineered masonry work and prepare reports.

.2 Allow testing agency access to scaffolding and work areas as needed to perform tests and inspections. Retest materials that fail to meet specified requirements.

.3 Tests Prior to Construction: One set of tests.

.4 Tests During Construction: One set of tests for each 300 sq. m (3300 sq.ft.) of wall area or portion thereof.

.5 Mortar and Grout Compressive Strength and Air Content Tests: For each mix provided, according to ASTM C780 for mortar; ASTM C1019 for grout.

3.16 CLEANING

.1 Clean installed work.

.2 Remove excess mortar and mortar smears as work progresses.

.3 Replace defective mortar. Match adjacent work.

.4 Clean soiled surfaces with cleaning solution.

.5 Use non-metallic tools in cleaning operations.

3.17 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

.3 Cover unfinished walls to prevent moisture infiltration.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required **TO COMPLETE STRUCTURAL STEEL INSTALLATION.**

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International):

.2 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel/ Structural Quality Steel.

.3 CSA S16, Design of Steel Structures.

.4 CAN/CSA S136 North American Specification for the Design of Cold-Formed Steel Structural Members.

.5 CSA S136.1, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

.6 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

.7 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.8 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

.9 CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.

.10 CSA W178.1, Certification of Welding Inspection Organizations

.11 Canadian Institute of Steel Construction (CISC):

.1 CISC, Handbook of Steel Construction.

.12 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA):

.1 CISC/CPMA 1, Quick-Drying One-Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2, Quick-Drying Primer for use on Structural Steel.

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

.1 ASTM A307, Standard Specification for Carbon Steel Bots, Studs and Rods 60,000 PSI Tensile Strength.

.2 ASTM A3125M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.3 ASTM A490M, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).

.4 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.5 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.

.6 ASTM F606, Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets.

.7 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

.8 ASTM F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

.14 Master Painters Institute:

.1 MPI-INT 5.1, Structural Steel and Metal Fabrications.

.2 MPI-EXT 5.1, Structural Steel and Metal Fabrications.

.3 Research Council on Structural Connections (RCSC):

.4 Specification for Structural Joints Using ASTM A325 or A490 Bolts

.5 The Society for Protective Coatings (SSPC):

.6 SSPC SP 6/NACE No. 3, Commercial Blast Cleaning.

1.3 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with the requirements of CSA S16-19 and CSA S136-16 to resist forces, moments, shears indicated or implied, and handling, transportation, and erection loads.

.2 Connections – General:

.1 Design in accordance with CSA S16-19 Clause 21 - Connections. Have designs completed by a Professional Engineer licensed to practice in the Province of Alberta.

.2 For normal framing, connections may be bolted or welded.

.3 Design connections for end reactions from torsion, bending moment, shear, and axial load were indicated on the Contract Drawings.

.4 Where no moments, shears, or axial loads are indicated, design in accordance with CSA S16-19 requirements for Simple Construction. Design connections to 90% of the ultimate shear capacity of the member.

.5 For beams with intersecting bracing members, design connections for beam reaction plus reaction from the bracing members.

.6 Detail connections of steel members so as not to interfere with architectural clearance lines or finishes.

.7 As a minimum provide 2-16M A-325 bolts per connection unless noted otherwise.

.8 Bolted Connections

.9 Unless noted otherwise in the Contract Documents, use bearing-type connections with snug-tightened bolts.

.10 Where indicated on the Contract Drawings, use slip-critical connections.

.11 Use high-strength bolts in accordance with CSA S16-19 Clause 22 - Design and Detailing of Bolted Connection.

.3 Use pre-tensioned bolts in accordance with CSA S16-19, Clause 22.2.2 - Use of Pretensioned High-Strength Bolts, for:

.1 Slip-critical connections.

.2 Connections proportioned for seismic design.

.3 Connections supporting running machines or other live loads that produce impact or cyclic loads.

.4 Connections where bolts are subject to tensile axial loads.

.5 Connections using oversize or slotted holes, unless designed to accommodate movement.

.4 For bracing and other tension and compression members, design connections, if not finished to bear, to develop the force due to full factored loads where indicated. Otherwise, design for 100 percent of the strength of the member, in tension or compression capacity, whichever governs.

.5 Design splices for the full strength of the member in torsion, bending, shear, and axial load unless noted otherwise in the Contract Documents.

.6 Provide a pair of bearing stiffeners on beams and girders at points of concentrated loads, such as at columns, monorail and crane runway beams, and equipment supports.

.7 Temporary bracing shall be in accordance with CSA S16-19 Clause 29.1 – Temporary Conditions. Bracing members shown on structural design drawings are not to be assumed as adequate for erection purposes.

.8 Where structural steel members specified on the Drawings are not available, contact the Consultant for written acceptance of any and all substitutions.

1.4 QUALITY ASSURANCE

.1 Employ a steel fabricator certified by the Canadian Institute of Steel Construction.

.2 Provide an affidavit from the structural steel fabricator stating that materials and products used in fabrication conform to the applicable material and product standards specified and indicated in the Contract Documents.

.3 Retain a Professional Engineer, licensed to practice in the Province of Alberta, with experience in design, fabrication, and erection of structural steel work of comparable complexity and scope, to perform the following services as part of the work of this Section:

.1 Design connections.

.2 Stamp and sign shop drawings, erection drawings and amendments.

1.5 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings and sketches stamped and signed by a qualified professional engineer licensed to practice in the Province of Alberta.

.3 Shop Drawings:

.1 Submit fabrication and erection documents. Include connection design details, shop details, erection drawings and erection procedures.

.2 Fabrication details shall include shop and field splices, connection details, cuts, copes, camber, bolt tension, holes, bearing plates, threaded fasteners, anchors, reinforcements, surface preparation and finishes, identification marks, and welds on shop details. Indicate welds in accordance with the CSA W59 welding symbols standard.

.4 Erection drawings:

.1 Indicate details and information necessary for assembly and erection purposes such as description of methods, member identification, sequence of erection, type of equipment used in erection, and temporary bracings.

.2 On erection drawings, mark each member with a number corresponding to the drawing containing the shop details of the member.

.3 Reproduction of the Contract Drawings for use as erection drawings is not permitted.

.5 Shop details and erection drawings together for each structure or part of structure.

.6 Connection design calculations and shop drawings

.7 Dimension shop drawings in S.I. metric units. Shop drawings not prepared in metric units will be rejected.

.8 Certifications:

.9 Submit certifications for welding companies under Division 1 or 2.1 in accordance with CSA W47.1 for fusion welding of steel structures, and CSA W55.3 for resistance welding of structural components.

.10 Submit confirmation by the Steel Fabricator's Engineer that fabrication and erection comply with the Contract Documents.

.11 Hot Dip Galvanizing: Submit a certificate of compliance signed by the galvanizer that describes the material process and applicable standard used for coating.

.12 Test Reports:

.1 Four weeks minimum, prior to structural steel fabrication, submit two copies of mill test reports by the steel manufacturer indicating chemical and physical properties of steel to be used in the Work and confirming that tests completed are in accordance with CSA G40.20/G40.21.

.2 Provide mill test reports certified by metallurgists qualified to practice in the Province of Alberta, Canada.

.3 Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.

1.6 CO-ORDINATION

.1 Contractor to review all contract documents and site conditions and advise Consultant of any discrepancy.

.2 Openings, bases, anchorages, precast concrete panel connections and similar items shown on the Drawings are for tendering purposes only. Verify sizes and layout with equipment and specialty shop drawings.

1.7 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in the Province of Alberta, with experience in the design, fabrication, and erection of structural steel Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:

.2 Design of structural members and connections.

.3 Stamp and sign Shop Drawings, design calculations, and amendments.

1.8 DELIVERY

.1 Exercise care in handling primer finished materials.

.2 Do not handle steel until primer paint has cured sufficiently to handle without damage to same. Use nylon slings for handling and a combination of wood or polystyrene blocking between units in stockpile and in transit.

.3 Schedule and sequence the Work so a minimum of handling occurs prior to erection.

.4 Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.

1.9 STORAGE

.1 Protect structural steel members and packed materials from corrosion and deterioration.

.2 Store in dry areas and not in direct contact with the ground.

.3 Protect fasteners from dirt and moisture. Do not remove the lubricant from bolts and nuts.

.4 Handle materials to avoid distortion or damage to members or supporting structures.

.5 Use nylon or padded cables for handling galvanized steel.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Prepare a Construction Waste Management plan in accordance with Section 01 74 11 – Cleaning.

.2 Separate and recycle waste materials.

.3 Remove from the Site and dispose of packaging materials at the appropriate recycling facilities.

.4 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material for recycling in accordance with the Waste Management Plan.

.5 Divert unused metal materials from the landfill to the metal recycling facility approved by the Consultant.

.6 Divert unused paint material from the landfill to the official hazardous material collections site approved by the Consultant.

.7 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

2 Products

2.1 MATERIALS

.1 Rolled structural steel shapes and flat hot-rolled steel: CSA G40.20/G40.21, Grade 350W.

.2 Hollow structural sections: CSA G40.20/G40.21, Grade 350W, Class C.

.3 Channels, angles, and plates: CSA G40.20/G40.21, Grade 300W.

.4 Cold formed shapes: CSA S136.

.5 Anchor rods: CSA-G40.20/G40.21, Grade 300W.

.6 Bolts, nuts and washers: ASTM A325 or ASTM A490, Type 1.

.7 Welding materials: CSA W59 and certified by the Canadian Welding Bureau.

.8 Grout: non-shrink, premixed grout as specified in Section 03 30 00 – Cast-in-Place Concrete.

.9 Primer: as specified in Section 09 90 00 – Painting.

.10 Zinc-rich primer for galvanized surfaces: zinc-rich, as specified in Section 09 90 00 – Painting.

.11 Hot dip galvanizing: to ASTM A123/A123M, minimum zinc coating of 600 g/m2, Coating Grade 85.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CSA S16-19, CISC Code of Standard Practice for Structural Steel Buildings, CSA W59, and in accordance with the reviewed shop drawings.

.2 Splicing of members is not permitted except as indicated on the Contract Drawings or with prior written approval of the Consultant.

.3 Mark and match mark materials for field assembly.

.4 Complete assembly, including bolting and welding of units, before the start of finishing operations.

.5 Field measure before fabrication.

.6 Provide camber as indicated on the Drawings.

.7 Continuously seal members by continuous welds where indicated on the Contract Drawings. Galvanize vent/weep holes for structural steel members.

.8 Grind shop fabrication welds smooth.

.9 The minimum size of welds shall be as required in CSA W59.

.10 Provide drain and vent holes in HSS members to be galvanized. Install plug holes after galvanizing.

.11 Do not fabricate steel members until erection diagrams have been returned. Any work done prior to return of erection diagrams will be at the fabricator's risk or at the Contractor's written request and risk.

.12 Flame cutting of structural steel shall be not permitted without the prior written approval of the Consultant.

2.3 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, MPI INT 5.1, EXT 5.1 except where members to be encased in concrete.

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.

.3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness of 15 to 25 mils, except:

- .1 Surfaces to be encased in concrete.
- .2 Surfaces to receive field installed stud shear connections.
- .3 Surfaces and edges to be field welded.
- .4 Faying surfaces of slip-critical connections.
- .5 Below grade surfaces in contact with soil.

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

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

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

2.4 GALVANIZING

.1 Galvanize exterior structural steel unless indicated otherwise in the Contract Documents. Provide galvanized bolts, nuts, and washers for exterior steel bolted connections.

.2 Fabricate steel to be galvanized in accordance with ASTM A123/A123M. Avoid fabrication techniques that could cause the distortion or embrittlement of steel.

.3 Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.

.4 Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.

.5 Hot dip galvanizes steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.

.6 Hot dip galvanize A325 and A490 bolts, nuts, washers, and hardware components in accordance with ASTM A123/A123M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts, nuts, and washers with special lubricant and test in accordance with ASTM A123/A123M.

.7 Galvanize components of bolted assemblies separately before assembly.

.8 Locally remove galvanizing from the surfaces to be welded. Welding galvanized surfaces shall not be permitted. Grind welds smooth and touch-up with zinc-rich prime after welding.

3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S16-19.

.2 Welding: in accordance with CSA W59.

.3 Companies performing welding to be certified under Division 01 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

.4 Flame cutting of structural steel will be not permitted without the prior written approval of the Consultant.

3.2 CONNECTION TO EXISTING WORK

.1 Verify the condition and dimensions of previously installed work upon which this Section depends. Report any defects to the Consultant. The commencement of the work shall constitute the Contractor’s acceptance of the existing conditions.

.2 Obtain the written approval from the Consultant prior to field cutting or altering of structural members.

3.3 MARKING

.1 Mark materials in accordance with CAN/CSA- G40.20/G40.21. Do not use die stamping. If steel is to be left in an unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: Shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

.1 Supply and coordinate the location and placement of anchor bolts and base plates.

.2 Provide templates and other devices for presetting bolts and other anchors to accurate locations.

.3 Where column vase plates are recessed in the concrete floor slab, any projection of anchor bolts beyond the face of the concrete floor surface shall not be permitted. Verify recess dimensions shown on the Contract Drawings for adequacy and notify the Consultant of any required modification to recess dimensions.

.4 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with erection drawings.

.5 Splicing of members shall not be permitted except as indicated on the Contract Drawings or as accepted in writing by the Consultant.

.6 Field cutting or altering structural members shall not be permitted without prior written approval from the Consultant.

.7 Set steel accurately to lines and elevations indicated. Set column bases and shim to proper elevations. Install structural grouting in accordance with details and the manufacturer's recommendations.

.8 Assemble structural steel members true, plumb and level, free of twists and open joints.

.9 Make high strength bolted connections in accordance with CSA S16.

.10 Weld in accordance with CSA W59.

.11 Install the Contractor designed temporary construction bracing to provide necessary support until components are in place and construction is complete.

3.5 FINISHING SYSTEMS

.1 Clean steel in accordance with SSPC SP 6, Commercial Blast Cleaning.

.2 Touch-up Painting:

.3 Upon completion of erection, mechanically brush clean bolts, rivets, welds and burned or scratched surfaces.

.4 Touch-up damaged surfaces and surfaces without shop coat with field touch-up primer or touch-up primer for galvanized steel as applicable

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 09 91 23 - Interior Painting

1.2 DEFINITIONS

.1 Application Specialist: An individual who performs surface preparation and application of protective coatings and linings to steel and concrete surfaces of complex industrial structures.

1.3 REFERENCE STANDARDS

.1 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)

.1 CISC/CPMA 2-75-1975, Quick-Drying, Primer for Use on Structural Steel.

.2 CISC/CPMA 1-73a-1975, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.2 CSA Group (CSA)

.1 CSA G40.20-13 /G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA S16-19, Design of Steel Structures.

.3 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members.

.4 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.

.5 CSA W55.3-08(2013), Certificate of Companies for Resistance Welding of Steel and Aluminum.

.6 CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric.

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.4 NACE International

.1 ANSI/NACE No. 13/SSPC-ACS-1-2016 -SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.

.3 Indicate particulars, on shop drawings, relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.

.4 Certificates:

.1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

1.5 QUALITY ASSURANCE

.1 Submit 3 copies of mill test reports minimum 4 weeks before fabrication of steel joists and accessories. Reports to show:

.1 Chemical and physical properties.

.2 Other details of steel incorporated into work.

.3 Certification by qualified metallurgists confirming that tests conform to requirements of CSA G40.20/G40.21

.2 Qualifications:

.1 Ensure that 50% of industrial coating specialist, who perform concrete and steel surfaces preparation and coating applications, are certified by a recognized Applicator Certification Agency, in accordance with NACE 13 /SSPC ACS-I, Applicator Certification Standard (ACS).

.2 Maintain a current and valid ACS certification during project period.

.1 Application specialists who perform surface preparation and coating application work on this project must have a current ACS.

.3 Notify Consultant of any change in application specialist certification status.

.1 Any delays to the completion of the Project due to invalid certifications will not be considered, and liquidated damages shall not be waived for any non-performance by Contractor.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Verify dimensions and condition of existing work; report discrepancies and potential problem areas to Consultant for direction before commencing fabrication.

2 Products

2.1 DESIGN CRITERIA

.1 Design steel joists and bridging to carry loads indicated on drawings to CSA S16.

.2 Design joists and anchorages for uplift forces as indicated.

.3 Manufacture joists to consider load effects due to fabrication, erection and handling.

.4 Limit roof joist deflection due to specified live load to L/240 maximum of span and deflection due to specified total load to L/180 maximum of span.

2.2 MATERIALS

.1 Open web steel joists: to CSA S16.

.2 Structural steel: to CSA G40.20/G40.21 and CSA S136.

.3 Welding materials: to CSA W59

.4 Shop paint primer: to CISC/CPMA-2.

.5 Shear studs: to CSA W59, Appendix H

2.3 FABRICATION

.1 Fabricate steel joists and accessories as indicated in accordance with CSA S16 and in accordance with reviewed shop drawings.

.2 Weld in accordance with CSA W59

2.4 SHOP PAINTING

.1 Clean, prepare and shop prime surfaces of steel joists to CSA S16 and SSPC SP6.

.2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces to SSPC SP1 brush blast.

.3 Apply one coat of CISC/CPMA 2 primer to steel surfaces to achieve dry film thickness of .065 mm to .080 mm maximum except:

- .1 Surfaces encased in concrete.
- .2 Surfaces to receive site installed stud shear connectors and steel decks.
- .3 Surfaces and edges site welded.
- .4 Faying surfaces of friction-type connections.
- .5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures minimum 5 degrees C.

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

.6 Strip paint bolts, nuts, sharp edges and corners before prime coat dries.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for steel joist framing installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 ERECTION

.1 Do structural steel work: to CSA S16 and CSA S136.

.2 Do welding in accordance with CSA W59

.3 Ensure installers certified to CSA W47.1 for fusion welding or CSA W55.3 for resistance welding

.4 Submit certification welded joints qualified by Canadian Welding Bureau.

.5 Erect steel joists and bridging as indicated to CSA S16 and in accordance with reviewed erection drawings].

.6 Complete installation of bridging and anchorages before placing construction loads on joists.

.7 Site cutting or altering joists or bridging not shown on shop drawings: to approval of Consultant.

.8 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.3 SITE PAINTING

.1 Paint: in accordance with Section [09 91 23 - Interior Painting].

.2 Touch up damaged surfaces and surfaces without shop coat with CISC/CPMA-1CISC/CPMA-2 in accordance with manufacturers' recommendations.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by steel joist framing installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

.2 09 91 23 - Interior Painting

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A 653/A 653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A 780-01 Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

.3 ASTM A 792/A 792M-10 (2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 10M-13, Standard for Steel Roof Deck.

.2 CSSBI 12M-15, Standard for Composite Steel Deck.

.3 CSA Group (CSA)

.1 CSA C22.2 No.79-2016, Cellular Metal and Cellular Concrete Floor Raceways and Fittings.

.2 CSA S16-14, Design of Steel Structures.

.3 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members including Update No. 1 (2014), Update No. 2. (2014), Update No. 3 (2015).

.4 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W55.3-09(R2014), Certification of Companies for Resistance Welding of Steel and Aluminum.

.6 CSA W59-13, Welded Steel Construction, (Metal Arc Welding) including Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).

.4 Green Seal Environmental Standards (GS)

.1 GS-11- Edition 3.2 (2015), Paints and Coatings.

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113- 2016, Architectural Coatings.

.2 SCAQMD Rule 1168- A2005, Adhesives and Sealants Applications.

.6 NACE International

.1 ANSI/NACE No. 13/SSPC-ACS-1- 2016 -SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

1.3 DESIGN REQUIREMENTS

.1 Design steel deck to CSA S136 and CSSBI 10M .

.2 Design roof composite steel deck to CSA S16 , CSA S136 , and CSSBI 12M .

.3 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.

.4 Deflection under specified live load maximum 1/240 of span, except when plaster/gypsum board ceilings hung directly from deck, live load deflection maximum 1/360 of span.

.5 Where vibration effects controlled as indicated, dynamic characteristics of decking system designed in accordance with CSA S16 .

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Submit design calculations if requested by Consultant.

.3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

.4 Certificates:

.1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13 .

1.5 QUALITY ASSURANCE

.1 Retain professional engineer registered or licensed in Alberta, Canada, with experience in steel deck Work of comparable complexity and scope, to perform following services as part of Work of this Section:

.1 Structural design of steel deck.

.2 Review, stamp, and sign Shop and erection Drawings, and revisions required.

.3 Monitor supplier's and fabricator's quality control tests and reports.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 Store materials off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect decking from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A 653/A 653M structural quality Grade 230, with ZF75 coating.

.2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.

.3 Zinc (Z) coated steel sheet: to ASTM A 653/A 653M structural quality Grade 230, with ZF75, coating, regular spangle surface, not chemically treated for paint finish, for exterior surfaces exposed to weather, 0.76 mm minimum base steel thickness.

.4 Aluminum-zinc alloy (AZ) coated steel sheet: to ASTM A 792/A 792M structural quality grade 230 , with AZ 150 coating, surface, not chemically treated for paint finish for exterior surfaces exposed to weather, 0.76 mm minimum base steel thickness.

.5 Acoustic insulation: fibrous glass 17.5 kg/m ^{3} density minimum profiled to suit deck flutes.

.6 Closures: in accordance with manufacturer's recommendations.

.7 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm minimum. Metallic coating same as deck material.

.8 Primer: to section 09 91 23 - Interior Painting.

.9 Caulking: to Section 07 92 00 - Joint Sealants.

2.2 TYPES OF DECKING

.1 Steel roof deck: 0.76 mm minimum base steel thickness, 38 mm maximum deep profile, interlocking side laps.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for steel decking installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation after unacceptable conditions remedied.

3.2 PREPARATION

.1 Locate bundles of deck materials to prevent overloading of supporting members.

.2 Install temporary shoring before placing deck panels, if required to meet deflection limitations.

3.3 ERECTION

.1 Structural steel work: in accordance with CSA S136 and CSSBI 10M and CSSBI 12M.

.2 Welding: in accordance with CSA W59 , except where specified otherwise

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel or CSA W55.3 for resistance welding.

.4 Erect steel deck as indicated and in accordance with CSA S136 and CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.

.5 Lap ends: to 50 mm minimum.

.6 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59

.7 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

.8 Openings and Areas of Concentrated Loads

.1 No reinforcement required for openings cut in deck maximum 150 mm square.

.2 Frame deck openings with dimension between 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.

.3 For deck openings with dimension minimum 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

.9 Connections: Install connections in accordance with CSSBI recommendations as indicated

3.4 SITE TOUCH-UP PAINTING

.1 Upon erection completion, mechanically brush clean bolts, rivets, welds, and burned or scratched surfaces.

.2 For galvanized steel surface with damage and without shop coat, repair with site touch up primer.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

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

.2 Repair damage to adjacent materials caused by steel decking installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Supply and install all miscellaneous metal work indicated on drawings and not included in the work of other Sections in addition to items listed in this Section.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

.2 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.3 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

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

.5 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip Plate, and Flat Bar

.6 ASTM C939, Standard Test Method for Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method)

.7 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with improved Formability, and Ultra-High Strength

.8 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

.3 American Welding Society, Inc. (AWS):

.1 AWS D1.6, Structural Welding Code – Stainless Steel

.4 Canadian Standards Association (CSA):

.1 CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

.2 CAN/CSA-G164-M92, Hot Dip Galvanizing or Irregularly Shaped Articles

.3 CSA-S16, Design of Steel Structures

.4 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members

.5 CSA W47.1, Certification of Companies for Fusion Welding of Steel

.6 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum

.7 CSA W59, Welded Steel Construction (Metal Arc Welding)

.5 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating

.2 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type

.3 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base

.6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers International (NACE):

.1 SSPC-SP 1, Solvent Cleaning

.2 SSPC-SP 2, Hand Tool Cleaning

.3 SSPC-SP 3, Power Tool Cleaning

.4 SSPC-SP 6/ NACE No. 3, Commercial Blast Cleaning

1.4 QUALITY ASSURANCE

.1 All Codes and Standards referred to in this Specification shall be current editions including all latest revisions and addenda.

.2 Conform to requirements of CSA-S16, Design of Steel Structures and CAN/CSA-S136, Cold Formed Steel Structural Members.

.3 Architectural metals work shall be of the highest architectural quality, free of scratches, pitting, roughness, marring, discoloration, staining and other imperfections.

.4 Work of this Section to be executed by firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturer's specializing in this work.

.5 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the site to direct the work of this Section.

.6 Where required by authorities having jurisdiction, have work of this Section designed by a professional engineer licensed to design structures and registered in the Province of the Work.

1.5 SUBMITTALS

.1 Provide submittals with bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Shop Drawings:

.1 Make thorough examination of drawings and details, determine the intent, extent, and materials, and be fully cognizant of requirements when preparing shop drawings.

.2 Submit shop drawings showing and describing in detail all work of this Section including large scale detail of members and materials, of connection and interfacing with work of other Sections, jointing details, and of anchorage devices, dimension, gauges, thicknesses, description of materials, metal finishing, as well as other pertinent data and information.

.3 Digital files of design drawings shall not be used in the preparation of shop drawings.

1.6 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather during delivery and storage. Damaged materials shall not be used and shall be replaced by approved material.

.3 Cover and protect the work of other Sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.

.4 Protect the installed work of this Section and on completion the work shall be examined, and damage shall be remedied to the complete satisfaction of the Consultant.

2 Products

2.1 MATERIALS

.1 Structural Steel Sections and Steel Plate: New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.

.2 Hollow Structural Sections (HSS): New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.

.3 Sheet Steel (Structural Quality): Conforms to ASTM A1011/A1011M.

.4 Sheet Steel (Commercial Quality): Conforms to ASTM A653/A653M, stretcher levelled, or temper rolled.

.5 Tube: Conforms to ASTM A53.

.6 Galvanized Sheet Steel (Commercial Quality): Galvanized coating G90 (Z275) in accordance with ASTM A653/A653M, minimized spangle, stretch levelled or temper rolled. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M.

.8 Stainless Steel Sheet, Strip, Plate, and Flat Bars: In accordance with ASTM A666, Type 304.

.9 Stainless Steel Bars and Shapes: In accordance with ASTM A276, Type 304.

.10 Aluminum Plate and Sheet: ASTM B209M, Alloy 6061-T6.

.11 Aluminum Extrusions: ASTM B221M, Alloy 6063-T6.

.12 Non-Shrink Grout: Premixed, high strength, maximum bearing, impact resistant, non-shrink non-metallic aggregate grout having minimum 55 MPa 28-day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, Master Flow 816 by Master Builders Solutions, or Sika Grout 212 HP by Sika Canada Inc.

.13 Galvanizing: All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot dip process according to CAN/CSA-G164, with minimum coating of 600 g/m^2 (2 oz./sq.ft.) Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.14 Primer Paint: CISC/CPMA 2-75.

.15 Bolts, Nuts, Washers: Conforms to ASTM A325.

.16 Welding Materials: Conforms to CSA W59.

.17 Metal Filler: Polyester based type.

.18 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.

.1 Touch-up Primer (On Site): Procryl Universal Acrylic Primer by Sherwin Williams Company of Canada Ltd or approved equal. Touch-up primer shall be no less than 3 mil dft.

.19 Zinc Rich Paint for Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.20 Refer to Section 09 90 00 – Painting for site finish paint requirement.

.21 Structural Steel for Fireproofing materials: Coordinate with fireproofing sections for primer requirement.

.22 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.23 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.24 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

2.2 FABRICATION

.1 Fit and assemble work in shop where possible. Execute work according to details and reviewed shop drawings.

.2 Take measurements at the building for work which is to fit or be connected to steel or concrete before commencing fabrication.

.3 Where shop fabrication is not possible, make trial assembly in shop.

.4 Do all welding in accordance with requirements of CSA W59, CSA W55.3 and CSA W47.1 including all supplements. Weld stainless steel electric arc process, to AWS D1.6. Grind welds smooth and flush with surface of parent metal, where exposed to view and where specifically indicated on drawings. Welds shall be continuous seam welds unless specified otherwise. Maintain sharp arises.

.5 Fit joints and intersecting members accurately in true planes, square, plumb, straight with tight joints and intersections.

.6 Provide adequate reinforcing, fastenings, anchors, accessories required for fabrication and erection of work of this Section. Such items occurring on or in an exterior wall or slab shall be hot-dip galvanized. Make thread dimensions such that nuts and bolts will fit without rethreading or chasing threads.

.7 Fabricate, drill and tap members to accommodate attachments, anchorage and work of other Sections where located and directed by them.

.8 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, weld marks, burrs, rust and scale.

.9 Gauges and sizes of metal shall be adequate for various conditions.

.10 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

2.3 SHOP PAINTING AND PROTECTION

.1 As per SSPC-SP2 Hand Tool Cleaning and SSPC-SP1 Solvent Cleaning, clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.

.2 Prepare steel as per SSPC-SP3 Power Tool Cleaning for interior members or SSPC-SP6 Commercial Blast Cleaning for exterior members. Remove rust, mill scale, oil, dirt, and other foreign matter before commencing shop painting.

.3 Apply shop coat of primer to all surfaces except areas requiring field welding. Apply by brush, working paint well into surfaces, interstices and cavities.

.4 Primer is to be free of runs, sags, or other collections of primer due to dipping of members into primer.

.5 Steel work shall be painted under cover, and shall remain under cover, until the paint protection is dry.

.6 Prime field welded areas after erection and touch up shop coat where damaged and barred by erection and handling.

.7 Prime steel with two full coats of paint in strict accordance with paint manufacturer's directions.

.8 Give the parts which are inaccessible after assembly two coats of primer coat paint of different colours, when members are noted to be painted.

2.4 HOT DIP GALVANIZING

.1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.

.1 Members exposed to elements when in final location.

.2 Members embedded on exterior side of exterior walls.

.3 Members imbedded in concrete.

.4 Members specified in this Section or indicated on Drawings.

.2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface

.1 4.8 mm (3/16”) and less member thickness: 600 g/sq.m (2 oz./sq.ft.).

.2 6 mm (1/4”) and heavier members: 640 g/sq.m (2.1 oz./sq.ft.).

.2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

2.5 ALUMINUM FINISHES

.1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

.2 As Fabricated Finish (Mill Finish): AA-M10, as fabricated mechanical finish.

.3 Clear Anodic Finish: AA-M12C22A41, as fabricated nonspecular mechanical finish, medium matte etched chemical finish, architectural class I clear anodic coating of minimum 18 um (0.7 mil) thick complying with AAMA 611.

2.6 STAINLESS STEEL FINISHES

.1 Polish Finish: Apply finish after fabrication. Remove tool and die marks and stretch lines or blend into finish. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

.1 Nondirectional Polish: AISI No. 8 mirror like reflective finish.

.2 Directional Polish: AISI No. 4 bright satin finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish, free of cross scratches. Run grain with long dimension of each piece.

3 Execution

3.1 GENERAL

.1 Verify at site that the Work to receive the work of this Section is free of irregularities detrimental to the installation and performance of the work and that it is located correctly and at proper levels before delivery and installation.

.2 Erection: To meet specified requirements of CAN/CSA-S16.

.3 Bearing Plates and Anchors: Standard.

.4 Anchors: Anchors to structural concrete shall be approved inserts set into concrete or approved self-drilling expansion insets drilled and placed afterwards.

3.2 INSTALLATION

.1 Assemble and erect work plumb, true, square, straight, level and accurate to sizes detailed, to reviewed shop drawings, free from distortion and defects detrimental to appearance and performance.

.2 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.3 Supply adequate instructions, templates, and if necessary, supervise installation of the fastenings or accessories requiring to be built-in by other Sections of the Work.

3.3 SCHEDULES

.1 Where items are required to be built into masonry, concrete or other work, supply such items to respective Sections with all anchors and accessories for building in.

.2 Itemized List: Supply and install metal work listed below unless specifically designated to be supplied only. Each item shall be as shown on drawings and as detailed on reviewed shop drawings.

.3 Miscellaneous Steel Framing, Channels, Angles, Plates and Brackets: As required and indicated on drawings.

.4 Loose Lintels:

.1 Provide and install loose lintels if not by structural steel.

.2 Finish: Hot-dip galvanized after fabrication.

.5 Bollards:

.1 Concrete fill steel pipe of diameters as indicated on drawings, having minimum 6 mm (1/4") wall thickness. Dome cap. Height above grade/floor shall be as indicated on drawings.

.1 In Grade Installation: Extend bollards 1500 mm (5’-0”) below grade.

.2 Co-ordinate with Section 03 30 00 – Cast-in-Place Concrete for concrete fill. Ensure that top of concrete shall be smooth and rounded.

.2 Finish:

.1 Exposed Bollard: Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.

.6 Masonry Lateral Supports:

.1 Install deflection space and lateral support for non-load-bearing masonry walls and partitions in accordance with specified requirements of CAN3-S304-M, where not provided by Section 05 12 00 – Structural Steel.

.2 At walls with concealed tops:

.1 75 mm x 50 mm x 6 mm (3" x 2" x 1/4") angles 203 mm (8") long on both sides of walls. Anchor to structure above wall.

.3 At walls with tops exposed to view:

.1 75 mm x 50 mm x 6 mm (3" x 2" x 1/4") angles, continuous on both sides of wall. Anchor to structure above wall.

.4 Finish: Prime paint.

.7 Frames for Overhead Doors:

.1 Supply and install 6 mm (1/4") thick bent steel plate around openings at heads and jambs to suit wall thickness and return 75 mm (3") on either side of wall face. Provide extensions on interior side at head to accommodate track and operators to suit doors specified.

.2 Co-ordinate installation with Sections 04 20 00 – Masonry, 05 40 00 – Cold Formed Metal Framing and 07 24 00 – Exterior Insulation and Finish System. Provide proper anchors for solid installation.

.3 Finish: Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.

.8 Overhead Doors Track Protection Guards:

.1 Provide 6 mm (1/4") thick x 1525 mm (60") high "Z" shaped bent steel plate track protection guards at overhead door tracks.

.2 Co-ordinate installation with work of other Sections. Provide proper anchors for solid installation.

.3 Hot-dip galvanized after fabrication, ready for painting by Section 09 90 00 – Painting.

.9 Entrance Vestibule Support Framing:

.1 Provide entrance vestibule support framing as required and indicated on drawings, having all welded construction. Framing shall be designed to provide a rigid trouble-free support including safety factor of 3 to 1.

.2 Finish: Prime paint.

.10 Corner Guards

.1 50 mm x 50 mm x 1525 mm (2" x 2" x 60") high stainless steel corner guard, secured to security grille wall, as indicated on the Drawings.

.11 Vertical Steel Ladders:

.1 Design products conform to Occupational Health and Safety (OHS) Act to provide overall legislative framework for workplace health and safety rules in Alberta.

.2 Fabricate stringers of 13 mm x 50 mm (1/2" x 2") flat bar stock, rungs of 19 mm (3/4") steel reinforcing bars 305 mm (12") on centre, or as detailed. Shoulder weld rungs to stringers. Secure stringers 150 mm (6") free from vertical wall surface with 13 mm x 50 mm (1/2" x 2") steel brackets, located at top, bottom and intermediately at not over 1525 mm (5'-0") O.C. Height to suit site condition.

.3 Securely fasten ladders to wall, plumb, rigid and secure. Fasteners shall be not less than 9.5 mm (3/8") diameter, secured into lead expansion shields in drilled holes in wall. At roof ladders at metal siding, provide steel channel supports behind metal siding secured to steel structure for proper anchorage and support.

.4 Where required or shown on drawings, provide steel flat bar safety cages to vertical steel ladders to requirements of authority having jurisdiction .

.1 Safety Cages: Continuous safety cage for ladder climbs of more than 5 m (16'-8") above ground, floor, roof or landing: Commence safety cages at not more than 2200 mm (7'-4") above grade, floor, roof or landing and extending minimum 900 mm (36") above top landing with access openings to top landing and platforms.

.5 Finish: Prime paint interior ladders (and safety cages where required), ready for painting by Section 09 90 00 – Painting and hot-dip galvanize exterior and tower ladders after fabrication.

.6 Acceptable Suppliers:

.1 O'Keeffe Inc.

.2 Global Industries Canada.

.12 Burglar Bars/Security Bars:

.1 Bars shall be 25 mm x 25 mm (1" x 1") steel bars at 203 mm (8") O.C. each way, spot welded at each contact point and welded to 50 mm x 50 mm x 6 mm (2" x 2" x 1/4") thick steel bar frame, sized to suit openings. Provide steel plate tabs welded to the frame for securing bars in place.

.2 Anchor security bars to structure/roof deck/wall with tamperproof "Torx" security fasteners at maximum 305 mm (12") O.C.

.3 Install security bars in all air intakes, ducted openings, and in all other openings in walls and roof where opening size is 305 mm x 305 mm (12" x 12") and over.

.4 Cover security bar "grid" with security mesh which is also welded to security bars where opening size is 305 mm x 305 mm (12" x 12") and over.

.5 Finish: Hot-dip galvanize after fabrication.

.13 Under-Counter Steel Supports:

.1 Framing: Continuous channel / angle welded construction.

.2 Drill 6 mm diameter holes at each cross support for fastening of counter.

.3 Provide concealed steel section posts to support channels at front of counter, for building into wall.

.4 Provide posts with anchor plates and 9 mm diameter bolts for attachment to structure.

.5 Unless otherwise indicated, provide intermediate posts to support long counter spans.

.6 Conceal framing from view to greatest extent possible.

.7 Prime paint finish. Finish paint by Section 09 91 00.

.14 Glazed Screen Lateral Bracing:

.1 Provide and install steel channel and angle suspended support framing complete with all diagonal bracing required for lateral stability, concealed in ceiling spaces for anchorage.

.15 Exterior Vestibule Door Guard:

.1 1067 mm (3'-6") high x 1220 mm (4') long exterior vestibule door guard of bent aluminum flat stock 50 mm (2") wide x 9.5 mm (3/8") thick, clear anodized finish.

.2 Weld guard to 100 mm x 100 mm (4" x 4") aluminum base plate, and mechanically fasten to concrete sidewalk.

.3 Weld mid-rail 406 mm (16") from grade, as indicated on drawings.

.4 Round all corners and grind all sharp edges.

.16 Other Miscellaneous Metal Components:

.1 Provide steel framing and supports not specified in other Sections as needed to complete the Work.

.2 Concealed metal angles and support not included in Division 5 sections.

.3 Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

.4 Support brackets and welded plates

.5 As required and indicated on drawings.

.6 Finish:

.1 Prime paint for interior components, ready for finishing by Section 09 90 00 – Painting and hot-dip galvanized after fabrication for exterior components.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply, fabrication and installation of:

.1 Steel Railings, as follows:

.1 Handrails and railings attached to stairs.

.2 Handrails attached to walls adjacent to stairs.

.2 Steel guardrails.

1.3 DEFINITIONS

.1 Field Dimensions: Actual dimensions measured on site and used by fabricator to construct required assemblies.

.2 Established Dimensions: Dimensions derived from drawings or that can be reasonably determined from adjacent construction where actual dimensions required by components fabricated in this section are not available; dimensions shall have suitable tolerances so that assemblies can be adjusted on site to fit actual field dimensions.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.2 ASTM A108, Steel Bars, Carbon, Cold-Finished, Standard Quality

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

.4 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

.5 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.6 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

.7 ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

.8 ASTM A653/A653M, Standard Specification For Steel Sheet, Zinc Coated (Galvanized) Or Zinc-Iron Alloy Coated (Galvannealed) By The Hot Dip Process.

.9 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with improved Formability, and Ultra-High Strength

.10 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.11 ASTM B241/B241M, Standard Specification for Aluminum and Aluminum Alloy Seamless Pipe and Seamless Extruded Tube

.12 ASTM C939, Standard Test Method for Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method)

.13 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

.3 Canadian Institute of Steel Construction (CISC):

.1 Handbook of Steel Construction, latest edition and revision.

.4 Canadian Standards Association (CSA):

.1 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.2 CSA W47.1, Certification of Companies for Welding of Steel Structures

.3 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding

.4 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

.5 CSA W59, Welded Steel Construction (Metal Arc Welding)

.5 National Association of Architectural Metal Manufacturers (NAAMM):

.1 NAAMM AMP 503, Finishes for Stainless Steel

.2 NAAMM AMP 510, Metal Stair Manual

.3 NAAMM AMP 521, Pipe Railing Systems Manual

.4 ANSI/NAAMM MBG 531, Metal Bar Grating Manual, 5th Edition

.5 ANSI/NAAMM MBG 533, Welding Specifications for Steel, Aluminum and Stainless Steel Bar Gratings, 2nd Edition.

1.5 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CAN/CSA S16.1, and applicable codes and authorities having jurisdiction.

.2 Design railing assemblies to withstand a minimum uniform load of 0.75 kN/m or a concentrated load of 1.0 kN at any point applied horizontally to top rail and a minimum of 1.5 kN/m applied vertically to top rail, with individual elements within the assembly designed for a concentrated load of 0.5 kN at any point in the element in accordance with the Building Code.

1.6 SUBMITTALS

.1 Shop Drawings: Provide shop drawings including, but not be limited to, the following:

.1 Sections and plans of railings indicating dimensions and assembly of components.

.2 Indicate fasteners, welds and connection details between railings; handrails; stairs, walls, brackets; reinforcements; anchors; and welded and bolted connections.

.3 Methods and locations of all exposed fastenings.

.4 Methods and locations of specified finishes.

1.7 QUALITY ASSURANCE

.1 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 510, 521, and 555; prepare fabrication and erection documents and materials lists in accordance with CSA S16-09.

.2 Fabricator shall have a minimum five (5) years documented experience fabricating metal railings and shall perform work of this Section to the highest standard of modern shop and field practice, by personnel experienced in architectural quality metalwork.

1.8 SITE CONDITIONS

.1 Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings where metal fabrications are indicated to fit walls and other construction.

.2 Establish dimensions and proceed with fabricating metal fabrications where field measurements cannot be made without delaying the work; allow for trimming and fitting.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Store materials in a location and manner to avoid damage; stack materials to prevent bending or applying stress to components; keep handling of materials on-site to a minimum.

.2 Store components and materials in clean, dry location, away from uncured concrete or masonry; cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation inside of covering.

.3 Correct damaged material and where damage is deemed irreparable by the Owner, replace the affected item at no additional expense to the Owner.

.4 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed and ready for final finishing.

.5 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

1.10 COORDINATION

.1 Coordinate fabrication schedule with construction progress to avoid delaying the work.

.2 Coordinate with Contractor so that field dimensions correspond to established dimensions.

.3 Coordinate shop priming and finishing requirements.

.4 Coordinate installation of anchorages for metal stairs.

.5 Supply items required to be built-in by other Sections, with instructions for installation for work not installed by this Section; install finish hardware and items supplied under other Sections required for completion of components of this Section.

2 Products

2.1 MATERIALS

.1 Use only materials that are new, free from defects that would impair the strength, durability or appearance, and of the best commercial quality for the purposes specified.

.2 Sheet Steel (Structural Quality):

.1 Conforms to ASTM A1011/A1011M

.3 Sheet Steel (Commercial Quality):

.1 Conforms to ASTM A1011/A1011M, stretcher levelled or temper rolled.

.4 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M-12.

.5 Aluminum Materials:

.1 Aluminum Sheet and Plate: In accordance with ASTM B209-10, Type 6063-T6 having clear anodized Architectural Class II Coating.

.2 Extruded Bar and Shapes: In accordance with ASTM B221, Type 6063-T6 having clear anodized Architectural Class II Coating.

.3 Extruded Tube and Pipe: In accordance with ASTM B241/B241M, Type 6063-T6 having clear anodized Architectural Class II Coating.

.6 Welding Materials:

.1 Conforms to CSA W59.

.7 Primer:

.1 Shop Applied Structural Steel Primer: Steel Spec Universal Primer (B50RV6227 Red), by Sherwin Williams Company of Canada Ltd., or approved equal. Apply a minimum of 2 mils dft./coat. Grey coloured primer is acceptable.

.2 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Seal tight Galvafroid Zinc-Rich Coating by W.R. Meadows of Canada Limited or Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.3 Touch-up Primer (On Site): 'Procryl Universal Acrylic Primer' by Sherwin Williams Company of Canada Ltd, or approved equal. Touch-up primer shall be no less than 3 mil dft.

.4 Refer to Section 09 90 00 – Painting, and coordinate with the above.

.8 Non-Shrink Grout:

.1 Premixed, high strength, maximum bearing, impact resistant, non-shrink metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, SikaGrout 212 by Sika Canada Inc., or approved equal.

.9 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.10 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.11 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

.12 Galvanizing:

.1 All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot-dip process according to CAN/CSA-G164, with minimum coating of 2 oz./sq.ft. Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

2.2 FABRICATION AND MANUFACTURE

.1 Design Requirements:

.1 Fabricate railings to conform to the Building Code, latest edition, in particular Division B, Part 4.

.2 General:

.1 Fabricate steel railings to details indicated on Drawings and to Metal Stairs Manual, AMP 510.

.2 Fabricate to reviewed shop drawings and in general to details indicated on drawings and specified herein. Where possible, fit and shop assemble and deliver to site in largest practicable sections.

.3 Fabricated work shall be complete with components required for anchoring.

.4 Fit joints and intersecting members accurately with hairline joints in least conspicuous locations and manner. Make work in true plane with adequate fastenings.

.3 Welding:

.1 Except where bolted connections are indicated, make railings of welded construction conforming to requirements of CSA W59.

.2 Grind exposed welds smooth. Machine materials and straighten in such a way that no disfigurement will show in finished work.

.4 Fastenings and Connections:

.1 Weld connections where possible. Where not possible bolt or otherwise secure in approved manner. Where approved, install exposed fastenings of same materials, colour and finish as base metal on which they occur.

.2 Countersink screws unless noted otherwise and reinforce where necessary.

.3 Use shop and field connections detailed. Where not detailed, connections shall comply with CSA S16.

2.3 COMPONENTS

.1 Railings and Handrails:

.1 Provide floor and wall mounted railings and handrails as indicated on drawings, complete with brackets, anchoring devices and removable sections.

.2 Handrails and Wall Brackets: Tubular steel, 38mm (1-1/2") dia. pipe rail with rod and mounting flange as detailed on Drawing.

.3 Finishing:

.1 Steel: After shop fabrication, thoroughly de-scale steelwork, remove roughness and irregularities by grinding, clean with wire brush, remove oil and grease from surface of steel and give one coat of primer. Give steelwork one coat of primer in shop working well into crevices and interstices. Leave ready for finish painting by Section 09 90 00 – Painting. Hot-dip galvanized exterior steel railings and handrails.

.2 Aluminum: Satin finish.

3 Execution

3.1 EXAMINATION

.1 Examine the work of other Sections upon which the work of this Section depends and report any defects to the Consultant. Do not commence installation until such time as all wet trades have been completed. Commencement of work implies acceptance of surface and conditions.

3.2 PREPARATION

.1 Provide anchorage devices and fasteners to other Sections where necessary for securing metal railings to in place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

.2 Perform cutting, drilling, and fitting required for installing metal railings.

.3 Field check and verify that structural framing, enclosures, weld plates, blocking, and that size and location of pockets are placed in accordance with reviewed shop drawings.

.4 Report discrepancies to Contractor and Consultant, and recommend corrective action by responsible parties.

.5 Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

.6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates and instructions for installation.

3.3 INSTALLATION

.1 Furnish, set and secure framing brackets, hangers, anchors, inserts or similar supports for proper erection of railings before masonry and concrete is placed. Provide temporary supports and bracing required to position railings.

.2 Do all coring, drilling and fitting necessary to attach work of this Section to adjoining work.

.3 Continuous weld connections between handrails and balusters and in lengths of handrails.

.4 Secure wall brackets to wall at 1220 (4') O.C. maximum with through-bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.

.5 Grout bases of posts, balusters or newels occurring in concrete using non-shrink grout in accordance with manufacturer's instructions. Finish smooth, level and flush with surrounding finished surface.

.6 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.7 Grind off surplus welding materials and provide sharp profiles and arises.

.8 Build and erect work plumb, true, square, straight, level and accurate, to sizes detailed, to reviewed shop drawings, free from distortion or defects detrimental to appearance and performance.

.9 Touch up with matching primer, or zinc rich paint for galvanized components, field welds, damaged and abraded surfaces, and surfaces not previously primed. Leave ready for finish painting by Section 09 90 00 – Painting.

3.4 PROTECTION

.1 Protect completed work from damage during and after installation.

.2 Field repair or refinishing of damaged, marred or discoloured finishes will not be accepted.

3.5 CLEANING

.1 Clean installations and assemblies progressively as work proceeds, and at completion of work.

.2 Remove protective coverings and clean metal work using cleaning solutions and methods to suit the metal and its finish at completion of work.

.3 Protect adjacent materials and finishes from damage or discolouring during cleaning.

.4 At completion, remove all equipment, tools, surplus materials and debris from job site.

3.6 PIPE HANDRAIL AND GUARDRAILING SCHEDULE

.1 Provide handrails and guardrails of the minimum diameter, standard weight pipe required to resist design loads, and as follows:

.1 Return ends of metal handrails toward guardrail after 305mm (12”) of straight run, with radius corners, leaving 200mm (8”) space between returned end and handrail.

.2 Space guardrail pickets a maximum of 100mm (4”) o.c.

.3 Design railings, and supports, in accordance with loads specified in the Building Code.

.4 Extend handrail horizontally not less than305mm (12”) beyond top and bottom of stairway or ramp in accordance with Building Code.

.5 Weld handrail and guardrail to stringer as indicated on Drawings.

.6 Cap the ends of tube rails with 3mm (1/8”) steel plate. Weld all around.

.7 Usage Classification: [Industrial] [Service] [Commercial]

3.7 PIPE HANDRAIL AND WALL BRACKETS SCHEDULE

.1 Provide handrails and brackets of the minimum diameter, standard weight pipe required to resist design loads, outer diameter 40mm (1.6”) unless otherwise indicated on the drawings, and as follows:

.1 Return ends of metal wall handrails toward wall with radius corner and stop handrail 13mm (1/2") from wall with flat end.

.2 Space brackets at a maximum of 1220mm (4’) and not more than 305mm (12”) from the ends.

.3 Design railings, and supports, in accordance with loads specified in the Building Code.

.4 At least one handrail at side of stairway or ramp shall extend horizontally not less than 305mm (12”) beyond top and bottom of stairway or ramp in accordance with Building Code.

.5 Weld posts to cast-in designed to resist post loads in accordance with the Building Code.

.6 Cap the ends of tube rails with 3mm (1/8”) steel plate. Weld all around.

.7 Usage Classification: [Industrial] [Service] [Commercial]

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete all rough carpentry work to the full intent of the drawings and as herein specified.

1.3 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Do not store seasoned materials under conditions that will cause their moisture content to increase.

.4 Protect edges and corners of sheet materials from damage during handling and storage.

.5 Store preservative treated materials under cover, off the ground and protected from moisture.

2 Products

2.1 MATERIALS

.1 Framing Lumber:

.1 Lumber for structural components shall be of species and grade specified, well-seasoned, processed and stamped at same mill with appropriate grade markings. Conform to requirements of Standard Grading Rules for Canadian Lumber of National Lumber Grades Authority the (NLGA) with latest supplements, approved by the Canadian Lumber Standards Administrative Board.

.2 Lumber:

.1 Except as indicated or stated otherwise, lumber to be softwood, S4S, moisture content 19% or less, in accordance with the following standards:

.1 CAN/CSA O141 - “Softwood Lumber”.

.2 NLGA - “Standard Grading Rules for Canadian Lumber” (latest supplement).

.3 Framing and Board Lumber:

.1 Treatable Species: No. 2 and better - S4S, Dry, 19%.

.4 Framing, Furring, Strapping, Blocking:

.1 Spruce, 122c, "Standard" light framing, except as otherwise specified.

.5 Plywood Sheathing:

.1 Shall be 19 mm (3/4") thick and/or thickness as indicated on drawings, exterior grade at exterior locations, Douglas Fir plywood, veneer core, Select Sheathing - Tight Face, unsanded, "B" faces and conforming to CSA O121.

.6 Plywood Roof Sheathing:

.1 Shall be minimum 13 mm (1/2") thick, exterior grade Douglas fir plywood, veneer core, tongue and groove edges, Select Sheathing - Tight Face, unsanded with non-slip surface one side, 'B' faces and conforming to CSA O121.

.7 Rough Hardware:

.1 Provide rough hardware such as nails, spikes, staples, H-clips, bolts, nuts, washers, screws, clips, strap iron and including hardware for temporary enclosures. Nails for plywood shall be annular or spiral type; all other nails shall be spiral type. All nails, spikes and staples shall conform to CSA B111. All rough hardware shall be galvanized unless otherwise noted. Galvanizing shall conform to CAN/CSA-G164.

.8 All Other Materials and Hardware:

.1 Shall be as noted on drawings.

2.2 PRESSURE PRESERVATIVE TREATED MATERIALS

.1 Pressure Preservative Treated Lumber: Lumber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Accreditation Board in accordance with CAN/CSA O80.

.1 Species: Pine or SprucePine

.2 Grade: No.2 or better structural posts and lumber, pieces may be grade stamped or shipment certified by letter of compliance.

.3 Grading authority: NLGA, paragraph 131CC

.4 Material having twisted grain or structural defects affecting integrity of lumber will not be acceptable for this project.

.5 Use only material with radius edges, minimum 6 mm.

.6 Kiln dry lumber materials to 8% moisture content or less.

.2 Pressure Preservative Treated Plywood: Treated in accordance with CAN/CSA O80 using waterborne preservative to obtain minimum net retention of 4 kg/m^3 (0.25 lb/ft^3) of wood. Plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.

2.3 PRESSURE FIRE RETARDANT TREATED MATERIALS

.1 Treat by pressure impregnation with fire-retardant chemicals in accordance with CAN/CSA O80 to provide classification for flame spread of not more than 25, smoke developed of not more than 75 in accordance with CAN4 S102.

.2 All fire-retardant wood must comply with the requirements in AWPA Standard C20 for lumber and C27 for plywood.

.1 AWPA C20: Structural Lumber, Fire Retardant Pressure Treatment, lumber materials shall only be of species listed. After treatment, lumber 50 mm (2”) or less in thickness shall be kiln dried to moisture content of 8% or less.

.2 AWPA C27: Plywood, Fire Retardant Pressure Treatment, plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.

.3 All species to comply with CAN4 S102 for surface burning characteristics and shall bear identification showing classification and type of fire retardant.

.3 Each piece or bundle of fire-retardant treated material or panel to bear ULC inspection label or stamp attesting to FRS rating indicating flame spread, smoke developed, and fuel contributed classification meeting AWPA standard C20 and C27 for Type A Use.

.4 Fire retardant chemicals used to treat lumber must comply with FR1 of AWPA Standard P17 and shall be free of halogens, sulphates and ammonium phosphate.

.5 Acceptable materials: Plywood and lumber materials treated by licensed applicators with fire retardant materials from the following:

.1 Dricon FRTW by Hickson Corporation.

.2 Pyro-Guard by Hoover Treated Wood Products Inc.

.3 D-Blaze by Chemical Specialties Inc.

2.4 GATE HARDWARE

.1 Gate Hinges: 8 mm (5/16") thick formed steel pintle and strap type gate hinges with 2 precision ball bearings, Size gate hinges to fully support weight of each gate and imposed loading. Provide 3 gate hinges per gate leaf.

.2 Padlock Hasps and Staples: Heavy-duty type. Provide 1 per pair of gates.

.3 Bottom Cane Bolts: 19 mm (3/4") diameter x 610 mm (24") long, formed steel bar with formed steel fittings. Provide one per pair of gates.

.4 Gate Handles: Formed steel bow type with 22 mm (7/8") diameter x 380 mm (15") with 70 mm (2-3/4") projection from face of gate. Provide 1 per gate leaf.

.5 Gate Position Holders: Heavy duty threaded eye bolt with 610 mm (24") long heavy duty chain with "end hook" to hold gate.

.6 All Other Materials and Hardware: As noted on the drawings.

.7 Gate Hardware: Wood Gate Hardware by Ameristar (Assa Abloy)

.1 Provide hinges, gate springs, gate pulls, latches and bolts as indicated. Hardware finish in colour black, powder coated.

2.5 WOOD SCREEN FENCE

.1 Refer to Appendix 2 for wood screen fence detail and requirements.

3 Execution

3.1 INSTALLATION-GENERAL

.1 Consult with and co-operate with other Sections in advance and build-in or make provisions for installation of other work.

.2 Provide and fit in place all furring, strapping, battens, nailers, sleepers, grounds and blocking required to provide adequate properly placed fixing for all wood finishes, fitments and as required for the work of other trades.

.3 Blocking, strapping and other rough carpentry indicated shall not be regarded as complete or exact. Provide all rough carpentry work required, whether specifically shown or not. Grounds shall be of a thickness to provide for application of finishes. Room side surfaces of grounds shall be plumb and in true plane throughout.

.4 All nails shall be long enough so that at least half their length penetrate in to the second member. Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping nails well in from edges.

.5 Blocking shall be through-bolted to structure.

.6 Anchor rough bucks to concrete or masonry with 9.5 mm (3/8") diameter expansion bolts and shields or Drummond and Reeves security buck anchors, minimum three per jamb.

3.2 WOOD BLOCKING, CANTS AND NAILERS

.1 Provide wood blocking, cants and nailers, where shown to be required as detailed. Bolt securely in place. Block under cants same thickness as installed roof insulation.

.2 Check mechanical, electrical, architectural drawings and provide all blocking, cants, nailers etc. required. Leave work ready for built-up bituminous roofing and prefinished sheet metal flashings.

3.3 PLYWOOD PANELS

.1 Provide plywood panels required for electrical/telephone mounting of equipment and in other locations as indicated on drawings.

3.4 ROOF SHEATHING

.1 Install roof sheathing with surface grain at right angles to the roof framing underneath with 2.4 mm (3/32") gap between adjacent panels to allow for expansion.

.2 All roof sheathing panel edges that are not tongue and groove require supports of minimum 38 mm x 38 mm (1-1/2" x 1-1/2") wood blocking securely fastened between roof framing members or use 'H' clips in conformance with O.B.C. article 9.23.15.1 and .2.

.3 Install roof sheathing to prefabricated wood trusses and framing using minimum 50 mm (2") long annular or spiral type nails spaced 150 mm (6") O.C. at edges and 305 mm (12") O.C. along intermediate supports.

.4 Install roof sheathing to cold formed metal joist trusses and framing using minimum 6 x 41 mm (1-5/8") long "bulge head" type drywall screws spaced 150 mm (6") O.C. at edges and 305 mm (12") O.C. along intermediate supports.

3.5 PRESSURE PRESERVATIVE TREADED WOOD INSTALLATION

.1 Comply with AWPA M4.

.2 Retreat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation. Allow first coating to fully soak into grain before applying second coating in accordance with manufacturer’s instructions.

.3 Remove with fine sandpaper, chemical deposits on treated wood to receive applied finish.

.4 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of preservative treated materials.

.5 Use water-borne preservative treated wood for:

- .1 Wood in contact with masonry or concrete,
- .2 Wood within 450 mm (18”) of grade,
- .3 Wood decking and fence boards,
- .4 Wood in contact with flashings,
- .5 Wood in contact with waterproofing membranes, confirm compatibility with membrane manufacturer prior to application.

.6 Use oil borne preservative treated wood for:

- .1 Wood in contact with the ground,
- .2 Wood in contact with freshwater,
- .3 Landscaping timbers,
- .4 Retaining walls,
- .5 Piers or docks,

.6 Pilings,

.7 Bases of utility poles,

.8 Bases of fence posts.

3.6 PRESSURE FIRE RETARDANT TREATED WOOD INSTALLATION

.1 Field Cuts:

.1 Do not rip, mill or conduct extensive surfacing of fire retardant treated lumber, label will be voided.

.2 Only end cuts, drilling holes and joining cuts are permitted.

.3 All cuts on plywood will be considered end cuts.

.4 Fire-retardant lumber and plywood can be given a light sanding for cosmetic cleaning after treatment.

.5 Pre-cut to the greatest extent possible before treating.

.2 Fire retardant treated plywood used in structural applications shall be graded or span rated material.

.3 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of fire resistant treated materials.

.4 Where humidity conditions are such that moisture may condense between hardware and treated wood, hardware shall be back primed with a corrosive inhibitive paint.

.5 Back prime at contact points and fasteners to prevent electrolysis when fire retardant framing members are used in metal buildings.

3.7 WOOD GATE:

.1 Co-ordinate wood gates with work of other Sections.

.2 Provide preservative pressure treated wood gate as indicated on drawings with all gate hardware. Set down nails in wood gates. Adjust and lubricate gate hardware for smooth and efficient operation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete all finish carpentry installation including but not limited to the following:

.1 Site fabricated and installed shelving and closet rods

.2 Wood handrails

.3 Hardwood Trim and accessories

1.3 QUALITY ASSURANCE

.1 Contractor executing work of this section shall have a minimum of five (5) years continuous Canadian experience in successful manufacture/fabrication and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Follow applicable requirements of The Architectural Woodwork Manufacturer's Association of Canada (AWMAC) Standard for Millwork latest edition, including supplements and modifications.

1.4 SUBMITTALS

.1 Samples for Verification: Submit two (2) samples prior to fabrication of millwork as follows; accepted samples will form the standard of acceptance for the remainder of the work:

.1 High pressure decorative laminate for finishing of millwork

.2 Solid surfacing countertop material

.3 Wood Handrail with Applied Opaque Finish: 12” long lumber for each finish system and colour.

.4 Exposed Fasteners, Hardware and Accessories: One unit for each type and finish.

.2 Shop Drawings:

.1 Submit detailed shop drawings of all shop fabricated finish carpentry components.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate sizes and locations of framing, blocking, furring, and reinforcements provided by work that is specified in other Sections is complete before starting work of this Section.

1.6 DELIVERY, STORAGE, HANDLING & PROTECTION

.1 Do not permit delivery of work of this section to site until area is sufficiently dry so that woodwork will not be damage by excessive changes in moisture content.

.2 Coordinate deliveries to comply with construction schedules and arrange ahead for under cover storage location.

.3 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect material with suitable non-staining waterproof coverings.

.4 Store material in original, undamaged containers or wrappings.

.5 Unsatisfactory materials shall be promptly removed from the site.

.6 Adequately protect the structure and work of other sections during delivery, storage, handling and execution of the work of this section.

.7 Provide tools, plant and other equipment required for the proper execution of the work of this section.

1.7 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings where casework is indicated to fit walls and other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work; locate concealed framing, blocking, and reinforcements that support woodwork by site measurements before being enclosed and indicate measurements on Shop Drawings.

.2 Established Dimensions: Establish dimensions and proceed with fabricating casework without confirmed site measurements where site measurements cannot be made without delaying the Work; coordinate with the construction to ensure that actual dimensions correspond to established dimensions; allow for trimming and fitting.

.3 Ambient Conditions: Maintain area or room in which casework is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with AWS for relative humidity and moisture content; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where casework is being installed.

1.8 WARRANTY

.1 Warrant plastic laminate work of this Section against defects in materials and workmanship in accordance with General Conditions but for an extended period of two (2) years and agree to repair or replace faulty materials or work which appears during warranty period, without cost to the Owner/Tenant. Defects shall include but not be limited to, opening of joints, cracking, shrinkage, warpage, delamination of plastic laminate.

2 Products

2.1 MATERIALS

.1 Framing Lumber:

.1 Lumber for structural components shall be of species and grade specified, well seasoned, and processed and stamped at same mill with appropriate grade markings. Conform to requirements of standard grading rule for Canadian lumber of Nation Lumber Grades Authority (NLGA) latest issue, approved by Canadian Lumber Standards Administrative Board, as follows:

.1 Rough Carpentry for built-in work: No. 2 select grade Ontario White Pine.

.2 Blocking, Ground, Furring and Strapping, Bucks and Nailing Strips: C.L.A. No. 1 grade pine, kiln dried stock.

.3 Non-Exposed Softwood: Fabricator's option, meeting requirements of CAN/CSA O141, kiln dried for interior use to a moisture content of 4% to 8%, and 7% to 10% for exterior use; Surface 4 sides (S4S).

.2 Hardwood: Oak, Birch, Ash, Maple or other species, as indicated on drawings and conforms to requirements of AWMAC Custom Grade and NHLA Select Grade.

.3 Panel Materials:

.1 Plywood: Douglas Fir veneer core plywood, 19mm (3/4") thick or thickness as indicated on drawings, Select Sheathing-Tight Face, good two sides, sanded "B" faces and conforms to CSA 0121.

.2 Particleboard: ANSI A208.1, 700 kg/m³ density.

.3 Medium density fibreboard (MDF): ANSI A208.2, density minimum 750 kg/m³, moisture resistant; standard of acceptance: Premier Plus MR MDF by Flakeboard.

.4 Solid Surface Panel: 6mm (1/4") thick homogeneous composite of natural minerals and prime acrylic polymer. Colour: As selected by the Consultant from the manufacturer's standard product line.

.4 Wood Mouldings: Provide interior [and exterior] millwork in accordance with AWS Section 6 for profiles and configurations required for the project and as follows:

.1 Hardwood Trim: Selected to meet AWS Premium Grade, kiln dried; species white maple finished lumber (S4S), selected for compatible grain and colour, edge grain (vertical), suitable for clear or stained finish in profiles indicated on Drawings for the following:

.1 Chair Rails.

.5 Glue: CSA 0112 , Type 1. Water-resistant urea-formaldehyde resin glue.

.6 Rough Hardware:

.1 Provide required rough hardware to frame and fix all finished carpentry and include for expansion shields, nails, spikes, screws, bolts, anchors, clips, plates, washers, rods, wires, wall brackets, chrome finishing trim, and other ironmongery which may be required. All wood screws shall be drill thread screws except at chipboard where self-tapping screws shall be used. All rough hardware shall be galvanized unless otherwise noted.

.7 Pass-Thru Door:

.1 Provide and install AISI type 304 stainless steel pass-thru door, complete with continuous stainless steel piano hinge and stainless steel barrel type slide bolts as indicated on drawings.

.2 Stainless steel shall have " No.4 Finish".

.8 Wall Mounted Standards and Brackets:

.1 Basis of Design Manufacturer: Knape & Vogt Canada.

.2 Wall Mounted Standards: 22mm (7/8") wide x 17.5mm (11/16") high 12 gauge heavy-duty wall mounted standards with 50mm (2") slot adjustment, 914mm (3') long and capable of supporting 65 lbs./100 sq.ft.

.3 Brackets: 305mm (12") heavy-duty steel brackets with single, moulded nylon cam lock lever.

.4 Shelf Rests: Provide end, centre and front type shelf rests, complete with rubber cushions as required and for joining 2 shelves on one bracket.

.9 Accessories:

.1 Garment Hooks: 133mm (5-1/4") high with 75mm (3") projection, institutional type garment hooks with bright chrome finish complete with mounting screws, '2038 CHR' by Knape & Vogt Canada.

.2 Closet Rods: Extension type zinc coated steel closet rods with zinc coated forged steel end brackets and 2 centre supports, 1524mm to 2438mm (60" to 96") extension type, complete with mounting screws, 'KV2 ZC' by Knape & Vogt Canada.

.10 Sliding Closet Doors:

.1 Medium Duty Sliding Track:

.1 Dual steel hanger with adjuster for by-passing top hung mounted doors.

.2 Four ground ball bearing steel tire wheels. Model C-911 Hangers by K.N. Crowder MFG. Inc.

.3 Track: Extruded Aluminum, 6061T6 alloy, 49.2mm (1-15/16") deep, Model C-104 Track by K.N. Crowder MFG. Inc.

.4 Load Capacity: 200lbs (Two Hangers).

.5 Basis of Design Product: Model C-911 by K.N. Crowder MFG. Inc.

.2 Door Guides:

.1 Guide Channel: Aluminum guide channel, recessed into bottom of door. Model C-914 Guide Channel by K.N. Crowder MFG. Inc.

.2 Roller Guide: Mounted to floor, single roller guide, Model C-913 Floor Guide by K.N. Crowder MFG. Inc.

.11 Pocket Doors: Supporting minimum 1-3/8” thick doors to 1-3/4” thick maximum doors.

.1 Track:

.1 Four ground ball bearing steel tire wheels, quick release type; Model C-411 Hangers by K.N. Crowder MFG. Inc.

.2 Track: Extruded Aluminum, 6061T6 alloy, 49.2mm (1-15/16") deep;
Model CP-801 Header Track by K.N. Crowder MFG. Inc.

.3 Load Capacity: 150lbs (Two Hangers).

.4 Basis of Design Product: Crowder frame Type C Pocket Door Kit by K.N. Crowder MFG. Inc.

.2 Accessories:

.1 Catch/Stop: Model CDC-411 by K.N. Crowder MFG. Inc.

.2 Steel Uprights: Supplied by pocket door manufacturer.

.3 Bumper and Spacer: Model C-99 Rubber Dome Bumper and Spacer by K.N. Crowder MFG. Inc.

.4 MDF Facia Board: Model CP-FB by K.N. Crowder MFG. Inc.

.5 Foot Bracket:

.1 2”x4” Wall Construction: Model CP-2X4 Foot Brackets by K.N. Crowder MFG. Inc.

.2 2”x6” Wall Construction: Model CP-2X6 Foot Brackets by K.N. Crowder MFG. Inc.

.6 Roller Guide: Mounted to floor, single roller guide, Model C-1200 Guide by K.N. Crowder MFG. Inc.

.7 Double Bi-Parting Door Joiner Kit: Model CPD-JOINER by K.N. Crowder MFG. Inc.

2.2 FABRICATION AND WORKMANSHIP

.1 Work shall be executed by skilled carpenters under the supervision of a competent carpentry foreman. All items shall be shop assembled, insofar as is practical. Unless indicated otherwise comply with AWMAC Custom Grade requirements.

.2 Make thorough examination of drawings and details, check anchorage, interfacing with work of other sections and other factors influencing the installation of the work, and be fully cognizant of requirements.

.3 Finished woodwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity of colour, grain and texture.

.4 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other sections.

.5 Fabricate the work in a manner which will permit expansion and contraction of the materials without visible open joints.

.6 Mitre exposed corners; no end grain shall be visible in completed installation.

.7 Provide solid wood edging at exposed plywood edges.

.8 Provide wood mouldings and wainscot to profiles as indicated on drawings.

.9 Jointing of shop assembled work shall be by means of mortise and tenons, dowels, stub tenons, dovetails, dadoes, lock joints as applicable for the jointing condition.

.10 Accurately cut, mitre, fit and frame work together to produce tight hairline joints, rigidly secured together in a permanent manner using glue, blind screw fixing or nails. Use concealed glue blocks for additional strength where possible.

.11 Finished woodwork shall be in one piece wherever possible and all trim shall be in long lengths. Where jointing is necessary in the length, the joints between pieces shall be scarfed, glued and properly fastened. The material being jointed shall match reasonably well for grain and colour where natural finish is specified. Joints between lengths where paint finish is to be applied may be finger jointed in lieu of scarfing. Trim shall be accurately cut and mitred at all corners, glued and properly fastened.

.12 Machine dressed work shall be properly machine using sharp cutters, the finished work shall be free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.

.13 Finished woodwork shall be carefully hand sanded after installation to remove roughness and planer marks. Sanding shall be done with the grain of the wood and finished with fine grit paper to leave a smooth scratch-free surface suitable to receive the paint or natural finishes to be applied over as specified in Section 09 90 00 – Painting.

.14 Nail heads in the finished surfaces shall be set with straight shank nail sets. Screw and bolt heads in finished surfaces shall be let into the work and capped with edge grain wood caps dressed and finished flush.

.15 Provide cutouts for sinks, fixtures, fittings, inserts, outlet boxes, services, other mechanical and electrical items and appliances. Round corners, and chamfer edges. Where items for cutouts butt to underside or back of finished surface, finish exposed edge to match face. Where item covers cutout, and at all concealed cut edges of core material, apply uniform coating of seal to cut edges.

.16 The finished work shall be of a high quality, with all corners having exact angles to ensure no swerve or twisting. All bends, crimps or angle parts shall be produced by professional equipment and tools for this purpose and if long runs or repeats are required, such shall be produced in the shop, or have proper equipment on site.

.17 Plastic Laminate Covered Components:

.1 Meet requirements of CAN3-A172, Appendix A.

.2 Bond plastic laminate to core with adhesive using pressure. Provide balanced construction with plastic laminate face sheet on exposed sides of core and backer/liner sheet. Finish drawers with liner sheet on both sides of core for balanced construction.

.3 Unless otherwise detailed, provide 19mm (3/4") thick core.

.4 Apply plastic laminate to core material in accordance with adhesive manufacturer's instructions. Provide same core and laminate profiles to provide continuous support and bond over entire surface.

.5 Use continuous lengths up to 2439mm (8'). Keep joints 610mm (2') from cutouts and in locations indicated on reviewed shop drawings.

.6 Locate joints, where required at 2439mm to 3048mm (8' to 10') O.C. At L-shaped corners mitre plastic laminate, to the outside corner. Accurately fit members together to provide tight and flush butt joints, in true planes. Provide 6mm (1/4") blind spline and approved type draw bolts; one draw bolt for widths up to 150mm (6") at maximum 457mm (18") centres for widths exceeding 150mm (6"). Colour-match adjoining units.

.7 Form shaped profiles and bends using postforming grade laminate to laminate manufacturer's instructions.

.8 Where curved or bent surfaces are required for counters, backsplashes and other areas, use postforming laminate.

.9 Self-edge straight-line-edging with general purpose laminate and radius corners with postforming laminate, of same colour and finish as facing sheet, to cover exposed edges of core material. Apply with same adhesive as facing sheet. Chamfer edges uniformly at approximately 20 deg using machine router. Do not mitre laminate edges.

.10 Fabricate horizontal wearing surfaces including counters, shelves, both sides of removable shelves, cabinet doors and drawer fronts, of general purpose laminate except where postforming is required.

.11 Use general purpose laminate for exposed vertical surfaces except where otherwise specified or indicated.

.12 Apply plastic laminate backing sheet to reverse side of core of plastic laminate finished work including under counter tops and concealed portions of plastic laminate faced work. Provide backing sheet of specified minimum thickness, increased as required to compensate stresses caused by facing sheet.

.13 Apply laminated plastic liner sheet to interior of cabinetry unless indicated otherwise.

.14 Assemble work, true and square. Arrange adjacent parts of continuous laminate work to match in colour and pattern.

2.3 MOISTURE CONTENT

.1 Moisture content of interior woodwork shall be between 8% and 12%.

2.4 FINISHES

.1 Finishes shall match approved finished samples of wood treatment submitted by this section for each species of wood required. Wood items provided under this section shall be finished as part of the work of this section.

.2 Apply stain to items where scheduled, indicated or as directed Consultant, providing uniform required stain colour(s).

.3 Provide finishes as indicated on drawings and scheduled, in accordance with requirements of Section 09 90 00 – Painting.

3 Execution

3.1 EXAMINATION

.1 Inspect available spaces and check surfaces over which the work of this section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in

writing of all conditions which are at variance with those on the Contract Documents and/or detrimental to the proper and timely installation of the work of this section. The decision regarding correct measures shall be obtained from the Consultant prior to proceeding with the affected work.

.2 Check humidity in building with moisture reading instruments if doubt exists that building is sufficiently dry and ready to receive millwork. Do not proceed until unsatisfactory conditions are corrected.

.3 Commencement of work indicates acceptance of surfaces and conditions.

3.2 INSTALLATION - GENERAL

.1 Provide and fit in place all furring, strapping, battens, grounds and blocking required to provide adequate properly placed fixing for all finish carpentry work and as required for the work of other sections.

.2 Refer to drawings and coordinate with drywall, the painting and floor covering sections to establish sequence of installation or execution of each others' work. Pay particular attention to areas where materials are supplied by others and installed under this Contract.

.3 All nails where their use is permitted, shall be long enough so that at least half their length penetrates into the second member. Splitting of wood members shall be minimized by staggering the nails in the direction of the grain and by keeping nails well in from edges.

.4 Unless otherwise permitted by Consultant, fasten finish carpentry components in concealed manner.

.5 Plastic laminate work shall be free of cracks and chipped or broken edges. Replace damaged components.

.6 Fitments shall be installed level, plumb and true and complete in all respects.

.7 Fit small scribe moulds of same material as fitment to hide voids at junction of fitment to fitment and fitment to walls, partitions, ceilings, furrings.

.8 Provide and install all pass-thru doors, cable entry plugs, computer paper feed slot guides, casters, wall mounted standards with brackets and accessories as indicated on drawings, secure, plumb, level and true to line to adjacent surfaces and items.

3.3 PRIMING

.1 Immediately in instances where primed work is cut (as for fitting), a coat of primer shall be applied to the resulting raw surfaces.

3.4 INSTALLATION - CABINET HARDWARE

.1 Install cabinet hardware in shop wherever possible.

.2 Install cabinet hardware secure, plumb, level, true to line, and in accordance with hardware manufacturers' instructions.

.3 Cut and fit to finish carpentry and millwork for proper installation and operation of cabinet hardware.

.4 Size cutouts so that hardware item completely covers cutouts.

.5 Adjust and lubricate cabinet hardware as required for smooth and efficient operation without binding.

3.5 INSTALLATION - FINISHING HARDWARE

.1 Take delivery of all finishing hardware and install. Check each item as received.

.2 Set, fit and adjust hardware according to manufacturer's directions at heights directed by Consultant. Hardware shall operate freely. Protect installed hardware from damage and paint spotting.

.3 Install all hardware for hollow metal doors including hinges. Prepare wood doors for installation with required bevels, clearances and mortices for hardware. Install wood doors, door grilles and all applicable hardware.

.4 Pre-drill kickplates and doors before attachment of plates. Apply with water-resistant adhesive and countersunk stainless steel screws.

3.6 INSTALLATION - WOOD DOORS

.1 Be responsible for damage to doors until acceptance by Consultant after installation.

.2 Fit and install doors complete with all hardware. Be responsible for the correct fitting of all doors. Warped or damaged doors will be rejected.

.3 Maintain an even clearance not exceeding 3/16" between door and frame on all sides to allow free action of doors.

.4 After trimming doors, have Section 09 90 00 – Painting, seal top and bottom edges of doors.

.5 Re-adjust and check doors upon completion of the building. Correct any restriction to free action of door.

.6 If lock of latch sets are installed before doors receive final finish by painter, remove such hardware prior to painter's work and re-install when finish completed.

.7 Where door frames are not satisfactory for the proper installation of doors, correct condition prior to installation.

3.7 INSTALLATION - WASHROOM SIGNAGE

.1 Install all washroom signs supplied by Section 08 71 00 at proper locations in accordance with sign manufacturer's installation directions.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete all FRP wall panelling work to the full intent of the drawings and as herein specified.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing of Materials (ASTM):

.1 ASTM D3678, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions

.2 ASTM D5319, Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels

1.4 SUBMITTALS

.1 Action Submittals:

.1 Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.2 Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

.3 Selection Samples: Submit manufacturer’s standard colour pattern selection samples representing manufacturer's full range of available colours and patterns.

.4 Samples for Verification: Submit appropriate section of panel for each finish selected indicating the colour, texture, and pattern required.

.1 Submit complete with specified applied finish.

.2 For selected patterns show complete pattern repeat.

.3 Exposed Molding and Trim: Provide samples of each type, finish, and colour.

.2 Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.5 QUALITY ASSURANCE

.1 Contractor executing work of this section shall have a minimum of five (5) years continuous Canadian experience in successful manufacture/fabrication and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meeting: Arrange a preconstruction meeting attended by Contractors personnel, Consultant, and wall paneling subcontractor to discuss:

.1 Installation requirements

.2 Special surface effects and finishing

.3 Coordination of work with adjacent finishes

.4 Protection of finishes

.5 Acceptability of substrates and quality of materials being used for the project

1.7 DELIVERY, STORAGE, HANDLING & PROTECTION

.1 Deliver materials factory packaged on strong pallets.

.2 Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (20 deg C) for 48 hours prior to installation.

1.8 SITE CONDITIONS

.1 Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (20 deg C) and ventilation consistent with good working conditions for finish work.

.2 Ambient Conditions: Maintain area or room in which wall paneling is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with manufacturers recommended humidity and moisture content.

1.9 WARRANTY

.1 Warrant wall paneling work of this Section against defects in materials and workmanship in accordance with General Conditions but for an extended period of two (2) years and agree to repair or replace faulty materials or work which appears during warranty period, without cost to the Owner.

.2 Defects shall include but not be limited to, opening of joints, cracking, shrinkage, and warpage.

2 Products

2.1 MANUFACTURER

.1 Specified Products: Work of this Section is based on products manufactured by Marlite Inc. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant’s acceptance.

2.2 PANELS

.1 Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D5319.

.1 Coating: Multi-layer print, primer and finish coats or applied over-layer.

.2 Dimensions:

.1 Thickness: 2.4mm (3/32") nominal

.2 Width: 1220mm (4') nominal

.3 Length: 3048mm (10’) nominal

.3 Tolerance:

.1 Length and Width: 3mm (+/-1/8")

.2 Square - Not to exceed 4mm in 3048mm (5/32" in 10') panels.

.2 Finish:

.1 Front Face: Pebble texture. P151 Light Grey colour.

.2 Back Face: Smooth texture. Imperfections which do not affect functional properties are not cause for rejection.

.3 Fire Rating: Class A Fire Rating.

.4 Basis of Design Product: Standard FRP by Marlite.

2.3 ACCESSORIES

.1 Trims and Moldings: Extruded PVC, ASTM D3678, for panel joints, corners and edges, one-piece design, as indicated and as recommended by panel manufacturer for complete capture of all edges and corners, integral colour to match panels. Provide radius inside corner molding.

.1 PVC Base Molding:

.1 100 mm (4”) high x 3048mm (10’) long base trim, Colour: Black.

.2 Other PVC Trim Profiles:

.1 M365 Inter Transition

.2 M350 Inside Corner

.3 M360 Outside Corner

.4 M370 Edge Cap

.2 Panel Adhesive: Water-based, low VOC contact adhesive as recommended by panel manufacturer.

.3 Sealant: Silicone sanitary sealant, as specified in Section 07 92 00 –Sealants. Colour: As selected by the Consultant.

3 Execution

3.1 EXAMINATION

.1 Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

.2 Verify that stud spacing does not exceed 24” (61cm) on-center.

3.2 INSTALLATION - GENERAL

.1 Comply with manufacturer's recommended procedures and installation sequence.

.2 Cut sheets to meet supports allowing 3mm (1/8”) clearance for every 2440mm (8') of panel.

.1 Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.

.2 Pre-drill fastener holes 3mm (1/8”) oversize with high speed drill bit.

.1 Space at 200mm (8”) maximum on center at perimeter, approximately 25mm (1”) from panel edge.

.2 Space at in field in rows 4877mm (16’) on center, with fasteners spaced at 305mm (12”) maximum on center.

.3 Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.

.1 Install panels with manufacturer's recommended gap for panel field and corner joints.

.1 Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.

.2 Drive fasteners for snug fit. Do not over-tighten.

.4 Apply trims and moldings to all panel edges to suit application, using silicone sealant providing for required clearances.

.1 All moldings must provide for a minimum 3mm (1/8") of panel expansion at joints and edges, to insure proper installation.

.2 Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.3 CLEANING

.1 Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

.2 Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

1 General

1.1 SUMMARY

1. This Section includes supply and installation of a self-adhering modified bitumen waterproofing for foundation walls, complete with primer, drainage board, and protection course required for a complete system installation.

1.2 REFERENCE STANDARDS

1. American Society for Testing and Materials (ASTM):
    1. ASTM D412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
    2. ASTM D882, Standard Test Method for Tensile Properties of Thin Plastic Sheet
    3. ASTM D1970/D1970M, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
    4. ASTM E96/E96M, Standard Test Methods for Water Vapour Transmission of Materials
    5. ASTM E154/E154M, Standard Test Methods for Water Vapour Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover

1.3 SUBMITTALS

1. Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
2. Action Submittals:
    1. Product Data:
        1. Submit copies of the most current technical data sheets, describing materials physical properties, and explanations about product installation, including installation techniques, restrictions, limitations and other manufacturer recommendations.
        2. Submit membrane manufacturer’s standard details that will be utilized for this project, indicate changes that must be made to make the details project specific for review by the Consultant.
    2. Samples: Provide samples of all materials required for work of this Section.
    3. Safety Data Sheets: Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on Site for reference by workers.

1.4 QUALITY ASSURANCE

1. Subcontractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful application of bituminous sheet membrane waterproofing work of type as indicated on drawings and specified herein. Submit proof of experience upon Consultant's request.
2. All membrane waterproofing products to be manufactured by or approved by one manufacturer, which includes but is not limited to the following:
    1. Primers,
    2. Mastics and membranes,
    3. Asphaltic protection boards,
    4. Composite drainage boards,
    5. Expansion joint membranes.
3. Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the Site to direct the work of this Section at all times.
4. Subcontractor executing work of this Section shall ensure that manufacturer's representative shall inspect substrates prior to commencement of work of this Section, during application of bituminous sheet membrane waterproofing and upon completion of work of this Section.

5. Subcontractor executing work of this Section shall ensure that manufacturer's representative shall provide technical assistance to applicator and assist where required in correct application of bituminous sheet membrane waterproofing materials.
6. Submit copies of the membrane manufacturer's current ISO certification including the manufacturing of the membrane, primer, mastics, adhesives, and asphaltic protection board.

1.5 PREINSTALLATION MEETING

1. Arrange a preconstruction meeting in accordance with Division 1 requirements.
2. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pre-treatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 STORAGE, DELIVERY, HANDLING AND PROTECTION

1. Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage area. Do not load any area beyond the design limits.
2. Material shall be carefully checked, unloaded, stored, and handled to prevent damage. Protect materials with suitable waterproof coverings.
3. Deliver and store waterproofing materials in the manufacturer's original containers and wrappers with seals intact.
4. Store solvent-based materials in safe areas well away from open flames or excessive heat.
5. Do not permit materials to freeze. Store materials at temperatures above 10 deg C.
6. Do not permit traffic of any kind over unprotected waterproof membranes. Do not allow backfill to be placed against unprotected waterproof membranes. Apply drainage board/protection board as soon as possible after installation of membrane.

1.7 COMPATIBILITY

1. All waterproofing membranes materials must be provided by the same manufacturer to ensure compatibility between products used for the different applications identified in this Section.

1.8 PROJECT CONDITIONS

1. Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer.
2. Apply waterproofing to dry substrates, when relative humidity is less than 85%, and when surface and ambient temperatures are 4 deg C above dew point.
3. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
4. Maintain adequate ventilation during application and curing of waterproofing materials.

1.9 WARRANTY

1. Warrant that the work of this Section shall remain free from leaks and from defects in materials and workmanship in accordance with the Contract Requirements, but for a period of five (5) years. Promptly make good defects within the warranty period without cost to the Owner.
    1. Warranty is inclusive for procedures to gain access to waterproofing membrane including removal and reinstallation of earthwork, protection board, drainage panels, and insulation.

2 Products

2.1 MANUFACTURERS

1. Compatibility: Verify that waterproofing systems identified in this Section are provided by a single manufacturer to ensure compatibility at intersections. Multiple manufacturers providing waterproofing systems on this project will not be accepted.
2. Provide a written declaration to the Consultant, from the waterproofing manufacturer, that the waterproofing materials and components are compatible, and that warranty period as specified in this section will be upheld at junctions between waterproofing systems required to waterproof the areas outlined in the Specifications and Drawings.
3. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    1. Henry Company
    2. Tremco Construction Products Group
    3. GCP Applied Technologies W.R. Meadows

2.2 MATERIALS

1. Bituminous Sheet Membrane:
    1. Self adhesive sheet membrane, SBS modified bitumen complete with a cross laminated polyethylene film, minimum 1.5 mm (60 mils) thick.
    2. Acceptable Products:
        1. Blueskin WP200 by Henry Company.
        2. TREMproof 560A by Tremco Construction Products Group.
        3. Bituthene 3000 by GCP Applied Technologies
2. Surface Primer: Adhesive type, quick setting for all temperatures, as recommended by membrane manufacturers.
3. Liquid Membrane and Termination Sealant: as recommended by membrane manufacturers.
4. Drainage Board and Adhesive: as recommended by membrane manufacturers.
5. Moulding Strip: Continuous 90mm (3-1/2") wide “Z” flashing strip to fit over exposed top edge of drain board.

3 Execution

3.1 EXAMINATION

1. Examine the vertical surfaces to which membrane is to be applied. Ensure that concrete has cured for at least 28 days, that all slabs slope to drains, that all surfaces are sufficiently smooth (plywood formed or wood float) and that surfaces to which membrane is to be applied are clean of waxy or oily substances, dust, dirt or other extraneous materials or any substance which might impair bond.
2. Do not apply membrane to damp or frosty surfaces. Ensure that all items penetrating the membrane, such as pipes, conduits, drains, and the like, are in place and rigidly fastened.
3. Report any defects of any conditions which might impair the performance of the membrane. Do not apply the membrane until defects have been corrected.
4. Commencement of work of this Section implies acceptance of surfaces and conditions.
5. Ensure that any required skim/mud slabs are placed in ample time and at correct levels.

3.2 PREPARATION

1. Priming:
    1. Apply primer in strict accordance with manufacturer's recommended rate.

2. Prime only areas which shall be covered with bituminous sheet membrane waterproofing in same working day.
3. Reprime areas contaminated with dust or not covered with membrane within 24 hours.
4. Allow minimum 30-minute open time.

2. Joint and Crack Treatment:

1. All cracks in concrete 1.5mm to 3mm (1/16" to 1/8") wide are to be pre-treated with a 1.5 mm (60 mil) coating of liquid membrane 50 mm (2") wide centred on the crack. Alternately, apply a 150 mm (6") wide strip of waterproofing membrane centred over crack. Provide 75 mm (3") end laps.
2. Horizontal to vertical inside corner transition areas are to be pre-treated with a liquid membrane fillet extending 19 mm (3/4") vertically and horizontally from the corner. Apply a minimum 229 mm (9") strip of waterproofing membrane centred at the joint.
3. All outside corners are to be pre-treated with a minimum 229 mm (9") strip of waterproofing membrane centred at the joint.
4. Where three or more planes come into contact reinforce with cut sections of waterproofing membrane reinforcing sheet as per manufacturer's instructions.

3.3 INSTALLATION - BITUMINOUS SHEET MEMBRANE WATERPROOFING

1. Installation of bituminous sheet membrane waterproofing shall be in strict accordance with manufacturer's written instructions.

2. Corner Detailing:

1. Form 19mm (3/4") fillet of liquid membrane at all inside corners and cover with minimum 305mm (12") wide sheet membrane strip centered on corner prior to installation of bituminous sheet membrane waterproofing.
2. Apply minimum 305mm (12") wide sheet membrane strip centered on all outside corners prior to installation of bituminous sheet membrane waterproofing.

3. Horizontal Surfaces:

1. Apply bituminous sheet waterproofing membrane from low point to high point so that laps shed water.
2. Stagger all end laps and overlap all seams minimum 75 mm (3").
3. Provide double thickness of bituminous sheet waterproof membrane over construction joints and cracks up to 3mm (1/8") wide.
4. Roll membrane in its entirety immediately following placement to ensure continuous adhesion to slab.
5. Tie-in under floor bituminous sheet membrane waterproofing with bituminous sheet membrane waterproofing system applied to walls, overlapping existing a minimum 457 mm (18"). Seal junction with continuous liquid membrane, minimum 3mm (1/8") thick and 25mm (1") wide.
6. Seal all "T" joints and sheet membrane terminations with liquid membrane, minimum 3mm (1/8") thick and 25mm (1") wide.

4. Vertical Surfaces:

1. Apply bituminous sheet membrane waterproofing vertically in full lengths.
2. Stagger all end laps and overlap all seams minimum 75mm (3").
3. Provide double thickness of bituminous sheet waterproofing membrane over construction joints and cracks up to 3mm (1/8") wide.
4. Roll membrane in its entirety immediately following placement to ensure continuous adhesion to walls.
5. Install securement bars at horizontal terminations, edges with liquid membrane.
6. Tie-in bituminous sheet membrane waterproofing with existing waterproofing system, overlapping existing a minimum 305mm (12"). Seal junction with continuous liquid membrane, minimum 3mm (1/8") thick and 25mm (1") wide.

7. Seal all "T" joints and sheet membrane terminations with liquid membrane, minimum 3mm (1/8") thick and 25mm (1") wide.

5. Protrusions:

    1. Apply bituminous sheet membrane waterproofing to within 25mm (1") of base of protrusion. Apply liquid membrane around protrusion, minimum 3mm (1/8") thick and minimum 75mm (3") on to sheet membrane.

6. Drains:

    1. Apply collar of membrane to drains, collar to extend minimum 6" beyond drain opening.
    2. Apply full coverage of bituminous sheet waterproofing membrane over the collar. Cut out drain opening so that the membrane extends under the clamping ring.
    3. Place a continuous bead of liquid membrane between the membrane waterproofing and clamping ring.

7. Repairs:

    1. Inspect bituminous sheet waterproofing membrane thoroughly and make any repairs before covering.
    2. Patch tears and inadequately lapped seams with bituminous sheet membrane waterproofing. Slit "fishmouths" and repair with bituminous sheet membrane waterproofing extending min 150 mm (6") in all directions of slit.
    3. Seal all repairs with liquid membrane.

3.4 INSTALLATION - DRAINAGE BOARD

1. Align and hang drainage up to foundation wall. Position bottom edge of drainage board to be in moderate contact with weeping tile system.
2. Secure drainage board to foundation wall with board adhesive. Apply adhesive using saw tooth notched trowel having 3mm (1/8") notches or apply a 6mm (1/4") diameter bead on 150mm (6") centres in a serpentine pattern.
3. Align and install termination strip along top edge with nails spaced 305mm (12") o/c and seal with termination sealant.
4. Align and install moulding strip over completed top edge detail.
5. Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the overlap flange of first panel.
6. Bend drain board to create inside corners and cut board to create outside corners, provide 75mm (3") of extra fabric to wrap corner.
7. Stagger or offset joints of drain board sheets.
8. Place all subsequent sheets in an overlapping single fashion.
9. Backfill bottom edge in conjunction with weeping tile system.

3.5 FIELD QUALITY CONTROL

1. An independent inspection and testing company appointed and paid for by the Owner will carry out inspection and testing in accordance with the General Conditions.
2. Arrange site meeting with inspection company representative three weeks prior to commencement of work of this Section on Site. Obtain inspector's instructions and procedures to be followed.
3. Co-operate with the inspector and afford all facilities necessary to permit full inspection of the work of this Section and testing of materials prior to their use. Act immediately on instructions given by the inspector.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of a cold applied below grade waterproofing membrane system, as required for complete and proper installation:

- .1 Fluid Applied Waterproofing Membrane
- .2 Fabric Reinforcement
- .3 Flashing Membrane
- .4 Flashing Membrane Adhesives
- .5 Mastics & Termination Sealants
- .6 Drainage Board
- .7 Protection Board
- .8 Auxiliary Materials

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing of Materials (ASTM):

- .1 ASTM C836/C836M, Standard Specification for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- .2 ASTM D412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers – Tension
- .3 ASTM D570, Standard Test Method for Water Absorption of Plastics
- .4 ASTM D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting
- .5 ASTM D903, Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
- .6 ASTM D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
- .7 ASTM D1876, Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)
- .8 ASTM D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- .9 ASTM D2243, Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings
- .10 ASTM D3330, Standard Test Method for Peel Adhesion of Pressure Sensitive Tape
- .11 ASTM D5385, Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
- .12 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
- .13 ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials

.14 ASTM E154, Standard Test Methods for Water Vapour Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 37.2, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Damp proofing and Waterproofing, and for Roof Coatings

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate the Work of this Section with the installation of exterior substrate; Sequence work so that installation of fluid applied waterproofing membrane coincides with installation of substrate preparation without causing delay to the Work.

.2 Pre-Construction Conference: Arrange a site meeting attended by the Contractor, the Subcontractor, the Consultant, materials supplier(s), and other relevant personal before commencement of work for this Section.

.1 Review methods and procedures related to installation, including manufacturer's written instructions;

.2 Examine substrate conditions for compliance with manufacturers installation requirements;

.3 Review temporary protection measures required during and after installation.

1.5 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer’s data sheets covering the care and recommended maintenance procedures for incorporation into maintenance manuals.

.2 Certifications:

.1 Submit copies of manufacturers’ current ISO 9001 certification. Fluid applied waterproofing membrane, adhesives and associated auxiliary materials shall be included.

.3 Submit references clearly indicating that the fluid applied waterproofing membrane manufacturer has successfully completed projects on an annual basis of similar scope and nature for a minimum of fifteen (15) years. Submit references for a minimum of ten (10) projects.

.4 Submit manufacturers’ complete set of standard details for the fluid applied waterproofing membrane showing a continuous plane of water tightness below grade.

.5 Provide material checklist complete with application rates and minimum thickness of adhesives and primers.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Submit in writing, a document stating that the applicator of the fluid applied waterproofing membrane specified in this section is recognized by the manufacturer as suitable for the execution of the Work.

.2 Perform Work in accordance with the manufacturer’s written instructions of the fluid applied waterproofing membrane and this specification.

.3 Maintain one copy of manufacturer's written instructions on site.

.4 At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the fluid applied waterproofing membrane manufacturers' representative.

.5 Components used in this section shall be sourced from one manufacturer; including fluid applied waterproofing membrane, sealants, primers, mastics and adhesives.

1.7 MOCK-UPS

.1 Mock-ups: Construct mock-ups to verify selections made under submittals and to set quality standards for materials and execution as follows:

.1 Where directed by Consultant, construct typical assembly, 2134mm x 2134mm (8' x 8'), incorporating substrate materials, fluid applied waterproofing membrane and adjacent materials including flashing, protection course, insulation, and drainage boards; showing fluid applied waterproofing membrane application details.

.2 Notify Consultant a minimum seven (7) days prior to mock-up construction.

.3 Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Consultant specifically notes such deviations in writing.

.4 Once reviewed by Consultant, acceptable mock-up can form a permanent part of the Work, and will form the basis for acceptance for the remainder of the project.

.5 Remove and replace materials found not acceptable, at no additional cost to Owner.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery: At the time of delivery, visually inspect all materials for damage. Note any damaged to materials on the receiving ticket and immediately report to the shipping company and the material manufacturer.

.1 Remove damaged materials from the site immediately.

.2 Storage:

.1 Store materials as recommended by manufacturer and conforming to applicable safety regulatory agencies. Refer to all applicable data including but not limited to MSDS sheets, Product Data sheets, product labels, and specific instructions for personal protection.

.2 Store materials off the ground and cover with a weather proof flame resistant sheeting or tarpaulin.

.3 Store role materials on end in original packaging.

.4 Store fluid applied waterproofing in closed containers outdoors.

.5 Store adhesives and primers at temperatures of 5 deg C (41 deg F) and above to facilitate handling.

.6 Keep solvent away from open flame or excessive heat.

.7 Protect rolls from direct sunlight until ready for use.

.3 Handling: Material shall be handled in accordance with sound material handling practices and in accordance with manufacturer's written instructions.

1.9 COORDINATION

.1 Ensure continuity of the water seal throughout the scope of this section.

.2 Ambient Conditions:

.1 Install materials outlined in this Section after completion of work by other Sections is complete; to provide adequate dry, clean, level, and plumb surfaces for installation and adhesion.

.2 Apply when ambient air and substrate temperatures are above temperature range indicated by fluid applied waterproofing membrane manufacturer, during time of install, and for a minimum of forty-eight (48) hours after installation, unless otherwise indicated.

.3 Ensure surfaces are sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants.

.4 Ensure surfaces are dry prior to and a minimum of sixteen (16) hours after time of install.

.5 Do not permit traffic of any kind over unprotected waterproof membranes. Apply protection course as soon as possible in accordance with manufacturers written instructions.

1.10 WARRANTY

.1 Contractor Warranty: Warrant that the fluid applied waterproofing membrane and membrane flashings will stay in place and remain leak proof for two (2) years.

.2 Manufacturer's Warranty: Fluid applied waterproofing membrane manufacturer must warranty the membrane and membrane flashings for leak coverage as a result of faulty materials for a period of [five (5) years] [ten (10) years] from the date of substantial completion.

2 Products

2.1 MANUFACTURERS

.1 Components and auxiliary materials must be obtained as a single-source from the assembly manufacturer to ensure total system compatibility and integrity.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

.1 Henry Company

.2 W.R. Meadows

.3 Carlisle Coatings and Waterproofing

.4 Tremco Commercial Sealants and Waterproofing

2.2 MATERIALS

.1 Fluid Applied Waterproofing Membrane:

SPEC NOTE: Unless required for federal government project, don't list performance characteristics when products are specified.

.1 Cold applied, elastomeric, one component asphalt emulsion waterproofing membrane.[, in compliance with CGSB 37.2, containing not less than 60% solids, and having the following characteristics:

.1 Solids by Weight: Not less than 60% Solids.

.2 Application Temperature: 5 deg C (40 deg F) minimum.

.3 Tensile Strength: 320 kPa (50 psi)

.4 Elongation (ASTM D412): 2000%

.5 Maximum VOC: 10 g/L

.6 Water Vapour Permeance (ASTM E96): 10 ng/Pa.m2.s., (0.2 perms)

.7 Hydrostatic Pressure Resistance: Passes 45 psi or 104 ft. at 65 mils]

.8 Basis of Design Materials:

.1 Henry Company, Aqua-Bloc 720-38

.2 W.R. Meadows, Hydralastic 836 Waterproofing Membrane

.3 Carlisle, MiraSEAL Fluid-Applied Waterproofing Membrane

.4 Tremco, TREMproof 250GC

.2 Fabric Reinforcement: Manufacturer's standard open weave glass fabric consisting of glass fibre yarn saturated with synthetic resins.

.3 Sheet Flashing: Nominal 1.6mm (1/16"), manufacturer's standard non-staining premanufactured elastomeric membrane and adhesive.

.4 Reinforcing Strip: Manufacturer's recommended fibreglass mesh or polyester fabric.

.5 Termination and joint Sealant: Polymer modified sealing compound, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.

.6 Drainage Board: 6mm (1/4") thick, dimpled designed, premoulded, high impact polystyrene core board with needle punched, non-woven, filter fabric adhered to core face and film adhered to core back.

.1 Drainage Board Adhesive: As recommended by the membrane manufacturer.

.7 Protection Board: 6mm (1/4") thick semi-flexible type protection board, consisting of a core of blended asphalt and mineral fillers, laminated between faces of asphalt saturated felts, conforming to DSM 9.90.60.

.1 Protection Board Adhesive: As recommended by membrane protection board manufacturer.

.8 Auxiliary Materials:

.1 Securement Bars (By Others): Continuous aluminum, stainless steel or galvanized metal, 3mm x 25mm x 25mm (1/8" x 1" x 1") in size and shall be pre-drilled for non-corrosive screw attachment on a maximum of 200mm (8") centers.

.2 Below Grade Insulation: As specified in Section 07 21 13 – Board Insulation.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation.

.2 Strike masonry joints flush. Concrete surfaces shall be smooth and without large voids, honeycombing, spalled areas or sharp protrusions.

.3 Notify Consultant in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.

.2 Notify Contractor in writing of any conditions that are not acceptable.

.3 The installing contractor shall examine and determine that surfaces and conditions are ready to accept the Work of this section in accordance with published literature. Commencement of Work or any parts thereof shall mean installers acceptance of the substrate.

3.2 PREPARATION

.1 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants.

.2 Provide adequate protection of materials and work of this section from damage by weather, backfilling operations and other causes.

.3 Protect adjacent surfaces and Work of other trades from damage resulting from Work of this section. Make good such damage at no additional cost to the Owner.

.1 Provide sound handling and installation procedures to prevent and protect against spillage and overspray of materials specified in this Section.

3.3 INSTALLATION

.1 Non-Moving Substrate Crack Treatment and Corner Treatment:

.1 Penetrations and Projections:

.1 Coat penetrations, such as brackets, clips, braces, etc. that are set into the concrete with a 2.3mm (90 mil) coating of fluid applied waterproofing membrane to height of wearing course and around projections to ensure a complete seal prior to coating the entire area.

.2 Flash penetrations subject to movement with fabric reinforcement set into a minimum thickness of 2.3mm (90 mil) coating of fluid applied waterproofing membrane to required height on wall and at least 100mm (4”) on slab. Embed fabric reinforcement into wet coating of fluid applied waterproofing membrane.

.2 Crack and Gap Treatment:

.1 Gaps up to 3mm (1/8”) wide: Apply a coat of fluid applied waterproofing membrane at a minimum thickness of 1.5mm (60 mil) and reinforce with fabric reinforcement. Embed 150mm (6”) wide fabric reinforcement into wet coating of fluid applied waterproofing membrane.

.2 Gaps between 3mm (1/8”) and 12mm (1/2”) wide: Apply sheet applied flashing membrane onto primed substrate. Roll sheet applied flashing membrane to ensure full contact with substrate. Overlap end joint of sheet applied flashing membrane a minimum 75mm (3”).

.3 Deck to Vertical Junctures:

.1 At monolithic deck to vertical junctures, apply fluid applied waterproofing membrane at a minimum thickness of 2.3mm (90 mil) to required height on wall and a minimum 100mm (4”) on slab. Embed fabric reinforcement into wet liquid applied waterproofing membrane.

.2 At non-monolithic deck to vertical junctures, apply flashing membrane to required height on wall and a minimum 100mm (4”) on slab, set into wet liquid applied waterproofing membrane.

SPEC NOTE: Single coat application is for vertical applications only; two-coat applications are used when horizontal applications are required.

.2 Fluid Applied Waterproofing Membrane – Single Coat Application:

.1 Apply a full and continuous coat of liquid applied waterproofing membrane, at a rate of 2.0 l/m2 (5 gal. U.S./100ft.2) to provide a minimum wet thickness of 2.3mm (90 mils) ensuring no pinholes or blisters. Allow liquid applied waterproofing membrane to fully cure prior to subsequent application coatings.

.2 Apply second coat of liquid applied waterproofing membrane if pinholes or blisters persist when curing.

.3 Fluid Applied Waterproofing Membrane – Two Coat Application:

.1 Apply a full and continuous prime coat of liquid applied waterproofing membrane, diluted 25% volume with clean water, at approximately 0.5 l/m2 (1.2 gal. US/100ft2) and allow to cure.

.2 Apply a full and continuous coat of liquid applied waterproofing membrane at approximately 0.5 l/m2 (1.2 gal. US/100ft2) and embed fabric reinforcement into wet coating of liquid applied waterproofing membrane. Brush fabric reinforcement into place with soft brush to eliminate wrinkles, air pockets or blisters and ensure no fishmouths are created. Allow liquid applied waterproofing membrane to fully cure prior to subsequent application coatings.

.3 Extend fabric reinforcement a minimum of 50mm (2”) at all joints.

.4 At corners and junctions, reinforce with two (2) additional coats of liquid applied waterproofing membrane and fabric reinforcement a minimum of 100mm (4”) on each side of corner or junction.

.5 Apply a seal coat of liquid applied waterproofing membrane over entire coated area at 1.0 l/m2 (2.4 gal./100ft.2) and allow to cure prior to placing protection and/or drainage board.

.4 Protection Board Installation:

.1 Install protection board over the fluid applied waterproofing membrane to prevent damage from backfilling.

.2 Apply protection board adhesive in 13mm (1/2”) wide strips spaced at 457mm (18”) o/c to fluid applied waterproofing membrane.

.3 Immediately embed protection board and press into adhesive to ensure full contact.

.4 Backfill once protection board adhesive has fully cured.

.5 Drainage Board Installation:

.1 Attach drainage board to surface using adhesive. Permanent fixing is achieved once backfilling operation is complete.

.2 Vertical Application: Place drainage board with fabric side outwards.

.1 Start at the top or bottom of the wall. Drain board may be applied horizontally or vertically.

.2 When installed horizontally, position edge of core with flange at the top. When installed vertically, align edge with flange at the upstream edge.

.3 Bottom panel should be placed behind the discharge pipe.

.3 Horizontal Application: Place drainage board with fabric side up.

.1 Start installation at lowest point to ensure positive drainage. Position edge of core with flange at the higher edge of the substrate, away from drains.

.4 Overlaps: Pull back loose fabric to expose core. Position core of second panel over the overlap flange of first level.

.1 Overlap in direction of water flow and adhere the overlapped fabric with adhesive to prevent soils and/or concrete from entering core.

.5 Corners: Bend drainage board for inside corners. Cut drainage board to reach corner, providing 100mm (4”) of extra fabric to wrap around corner. Overlap fabric at joint.

.6 Insulation Installation:

.1 Co-ordinate with Section 07 21 13 – Board Insulation for insulating materials.

.2 Adhesive (Optional):

.1 Apply the insulation adhesive in a serpentine pattern to fluid applied waterproofing membrane.

.2 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.

.3 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.

.4 Stagger the end joints of the insulation.

.5 Cut the insulation to fit closely to all protrusions and obstructions.

.3 Insulation Clips:

.1 Mechanically fasten insulation clips to the fluid applied waterproofing membrane with adhesive recommended by insulation clip manufacturer.

.2 Apply number of insulation clips as recommended by insulation manufacturer, in locations indicated in their written documentation.

3.4 FIELD QUALITY CONTROL

.1 Final Observation and Verification:

.1 Final inspection of fluid applied waterproofing membrane shall be carried out by the Owner's representative, and the contractor.

.2 Contact Manufacturer for warranty issuance requirements.

.2 Fluid applied waterproofing membrane is not designed for permanent UV exposure. Apply protection as soon as possible after installation of fluid applied waterproofing membrane. Refer to manufacturer published literature for product limitations.

3.5 CLEANING AND PROTECTION

.1 Progress Cleaning: Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.

.2 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Provide labour, materials, products, equipment and services to complete the pedestrian traffic topping waterproofing system in [Generator Room] [as indicated on drawings] [, Room Finish Schedule] [and as specified herein].

1.3 QUALITY ASSURANCE

.1 The Contractor executing work of this section shall have minimum of 5 years continuous Canadian experience in the successful installation of work type and quality indicated and specified herein. Submit proof of experience upon Consultant's request.

.2 Contractor shall ensure that pedestrian traffic topping manufacturer provides periodic site visits and supervision of preparation and installation.

.3 Contractor executing work of this section shall be pedestrian traffic topping manufacturer's approved applicator. Contractor shall submit proof of manufacturer's approval, signed by duly authorized person at manufacturer.

1.4 SUBMITTALS

.1 Product Data: Provide data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of pedestrian traffic topping membrane.

.2 Samples:

.1 Provide 305mm x305mm (12" x 12") samples representative of finished work, showing colour, thickness and finish. Provide a variety of slip resistant surface applications for Consultant to select from. Identify finish, colour and manufacturer

.3 Safety Data Sheets:

.1 Provide WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on site for reference by workers.

.4 Maintenance Data:

.1 On completion of the work of this Section, submit 3 copies of maintenance data for inclusion into operation and maintenance manual.

1.5 PRE-INSTALLATION CONFERENCE

.1 Contractor shall hold pre-installation conference 2 weeks prior to commencing work of this section. Conference shall be attended by the Contractor, pedestrian traffic topping installers and manufacturer's representative to discuss the following:

.1 Substrate conditions and preparation.

.2 Scheduling of installation.

.3 Installation procedures.

.4 Coordination with work by other sections.

1.6 MANUFACTURER'S REPRESENTATIVE

.1 Contractor shall ensure that manufacturer's representative provides continual recommendation and periodic site visits to ensure that work of this section is installed in strict accordance with the manufacturer's written instructions.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Store materials in locations designated on site.

.2 Store flammable materials in locations approved by local fire authorities.

.3 Maintain storage area temperatures and store materials in accordance with manufacturer's instructions.

1.8 SITE CONDITIONS

.1 Ensure that air and substrate temperatures are maintained before, during and after application in accordance with manufacturer's instructions. Provide adequate ventilation during and after application.

.2 Post signs, during application and curing, at points of entry to pedestrian traffic topping application areas, warning of safety precautions required during work of this section.

1.9 WARRANTY

.1 Warrant the work of this section against defects in materials and workmanship in accordance with the General Conditions, but for a period of 3 years. Contractor shall agree to promptly and at the Owner's convenience make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but shall not be limited to cracking, blistering, peeling, delamination, leaking, crazing, spalling, pitting, dusting or softening and excessive colour change under normal usage of intended occupancy.

.2 Pedestrian traffic topping shall remain watertight over shrinkage cracks and other cracks 1/16" wide or less. Cracks arising from normal shrinkage and/or expansion of concrete shall not be considered as structural failure. Hairline cracks which result from these causes shall be considered normal and consequently the warranty shall not be voided as a result of these minor defects.

2 Products

2.1 MATERIALS

.1 Pedestrian traffic topping system: Water based or high solids system consisting of applied epoxy urethane or polyurethane waterproofing membrane with slip resistant epoxy wear course, minimum total system thickness of 762 um (30 mils) DFT, meeting or exceeding the following performance requirements:

.1 Performance Requirements - Physical Properties:

Property	**Standard**	**Results**
Tensile strength	ASTM D412	6.7 MPa (972 psi)
Elongation at break	ASTM D412 at 70F	300%
Crack Bridging	ASTM C957	1.6 mm (1/16")
Tear Resistance	ASTM D624	25 KN/mm (149 psi)
Adhesion in Tension	ASTM D4541	100% cohesive conc. failure
Water Tightness	CGSB 37.58-M86	Pass
Abrasion Resistance	ASTM D4060	90 mg loss
Fire Resistance	CAN/ULC-S102.2	Flame Spread: 0
		Smoke Developed: 5

.2 Products:

.1 Resoclad MRW Type II by Sika Canada Inc.

.2 Stonproof ME7/ Stonkote GS4 by Stonhard Canada Ltd.

.3 Vulkem 350NF/351NF by Tremco Canada Ltd.

.3 Manufacturer's standard colour, or as later selected from standard range.

.2 Sealant: For traffic locations as specified in Section 07 92 00 – Sealants

.3 Aggregate: Clean, coarse, sharp sand, 85% passing through 20-40 mesh.

.4 Filler: Latex modified cementitious subfloor filler recommended by the pedestrian traffic topping manufacturer.

.5 Sealant: As recommended by the pedestrian traffic topping manufacturer.

.6 Metal Surface Conditioner: As recommended by the pedestrian traffic topping manufacturer.

3 Execution

3.1 EXAMINATION AND PREPARATION

.1 Before applying pedestrian traffic topping, examine the preceding work of other trades for defects detrimental to the application or performance of the topping. Report defects to the Consultant in writing for correction before work progresses. Commencement of work shall imply acceptance of all conditions and substrates.

.2 Free surfaces to receive the work of this Section from dust and loose particles, grease, paint, front, form oil and other material detrimental to the bond of the pedestrian traffic topping. Employ steam cleaning where necessary to remove form oil. Acid etch, sandblast, or abrade and clean using a steel shot blast machine having vacuum pick-up, whichever is deemed necessary, depending on the condition of the concrete. Ensure surfaces are dry at commencement of work and cured minimum of 28 days. Remove all dust and dirt with industrial type vacuum cleaner.

.3 Substrate surfaces shall be free from cavities and/or shutter marks which will damage the pedestrian traffic topping.

.4 Ambient and surface temperatures shall be at least 10°C for a minimum period of 48 hours before, during and after membrane application.

.5 Ensure that substrates slope properly to drains.

.6 Ensure applied pedestrian traffic topping is flush with top of floor drains.

.7 Remove subfloor ridges, bumps and clean floors. Fill low spots, cracks, joints, holes and other defects with subfloor filler to provide smooth, flat surface. prohibit traffic until filler has cured.

.8 Floor surface shall be level to a tolerance of 1:1000.

.9 Fill tooled vertical block joints, voids and chips occurring behind base flush to provide continuous, clean, dry, smooth, solid backing.

3.2 INSTALLATION

.1 Apply materials in accordance with pedestrian traffic topping manufacturer's written instructions.

.2 Treat and fill control joints in accordance with the manufacturer's instructions.

.3 Apply primer at coverage rate recommended by manufacturer for the particular surface porosity. Do not permit primer to collect in pools. Prevent seepage through joints. Allow primer to dry thoroughly.

.4 Apply continuous 13mm x 13mm (1/2" x 1/2") sealant cant to all internal angles. Sealant cant shall be compatible with base coat.

.5 Apply base coat in strips to substrate surfaces, double coating cracks and joints.

.6 Seal base coat around vent pipes, drains and other protrusions.

.7 Apply metal surface conditioner to metal surfaces to receive the pedestrian traffic topping.

.8 Apply base coat in multiple coats to achieve 762 um (30 mils) dry film thickness. Work coatings into corners and other restricted areas. Ensure full coverage at outside edges and corners.

.9 Turn primer and base coat up vertical surfaces minimum 152mm (6") or 203mm (8") unless indicated otherwise on Drawings or Schedules.

.10 Apply top coat in 2 coats with total thickness of 254 um (10 mils).

.11 Apply first coat of top coat 127 - 178 um (5 - 7 mils) thick. Work top coat into corners and restricted areas. Ensure full coverage of base coat at edges, corners and bases.

.12 While first coat of top coat is wet, uniformly broadcast non-skid aggregate by "shake" method at a rate of 8.6 to 10.8 kg per square meter (8 to 10 lbs. per 100 sq. ft.) or greater to provide a "medium" non-skid surface.

.13 Proof roll non-skid aggregate into wet top coat. When surface is tack-free, remove excess aggregate by lightly cleaning top coat with broom.

.14 Apply second coat of top coat 76 um – 127 um (3 - 5 mils) thick. work top coat into corners and restricted areas. Ensure full coverage of first top coat at edges, corners and bases.

.15 Apply diesel resistant top coat using the same methods used for top coat to produce a "medium" non-skid surface.

.16 Top of finished top coat base shall be straight and level to variation tolerance of 1:1000.

.17 Terminate pedestrian traffic topping system at centre line of door in opening where adjacent floor finish is dissimilar.

.18 Continue pedestrian traffic topping system over equipment pad and curbs and over areas which will be under built-in fixtures and equipment.

.19 Pedestrian traffic topping system shall be total thickness of 1 mm (40 mils).

.20 Provide temporary protection until pedestrian traffic topping system has fully cured.

3.3 FIELD QUALITY CONTROL

.1 Inspect the work of other sections where such is associated with the pedestrian traffic topping system including the placement, finishing and curing of the concrete substrate.

.2 Owner may engage the services of an independent inspection and testing company to carry out inspection and testing of material and installation of pedestrian traffic topping.

.3 Cost of such inspection and testing for Owner's quality control, if required, shall be paid by Owner.

3.4 CLEANING

.1 Clean and make good to the consultant's satisfaction, surfaces soiled or otherwise damaged in connection with the work of this section. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.

END OF SECTION

SPEC NOTE: THE WORK OF THIS SECTION IS RESTRICTED TO PARKING GARAGE AND COMMERCIAL LOADING DOCKS.

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Supply and install vehicular traffic coatings within parking garages [and loading docks], consisting of the following to provide a full system:

.1 Primer

.2 Base Coat

.3 Wear Coat

.4 Top Coat

.5 Wall Base Coating

1.3 SUBMITTALS

.1 Provide product data and sample showing compliance with specified requirements.

.2 Provide maintenance proposal detailing proposed inspection services and costs of providing maintenance services.

.3 Provide certificate, after installation, signed by applicator and manufacturer stating that work complies with specified requirements.

1.4 QUALITY ASSURANCE

.1 Installer: Trained and approved by the manufacturer and having a minimum three years experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.

.2 Maintenance Seminars: Instruct Owner’s personnel on proper care, cleaning and maintenance procedures.

.3 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.4 Manufacturer’s Site Inspection: Have the manufacturer’s technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. When requested, submit manufacturer’s inspection reports and verification that the work of this Section is correctly installed.

.5 Testing of Concrete Floors: Test floors that have been cured for minimum 28 days, and after preparation for Product installation is complete and patching or levelling compound is fully cured. Conduct testing simultaneously on floors free of sealer, curing compounds, oil, grease and other agents detrimental to the test and Product performance. Locate test sites to cover representative installation areas. Do not proceed with work when the test results do not conform to the specified allowable.

.1 Cohesive Strength: Minimum 1.5 MPa (210 psi) by tensile load as tested to CSA A23.2-6B. Do one test for every 92 sq.m. (1000 sq.ft.) or fraction thereof.

.2 Moisture Vapour Transmission: ASTM D4263 plastic sheet method, no visible condensation or vapour allowed. Do one test for every 45 sq.m. (500 sq.ft.) or fraction thereof.

.3 Surface Moisture Content: Maximum 4%, tested by moisture meter. Do one test for every 46 sq.m. (500 sq.ft.) or fraction thereof.

.4 Surface Temperature: Minimum 3 degree C above the measured dew point.

1.5 MOCK-UP

.1 Provide a minimum 5m x 5m (15' x 15') sample installation complete with based on the Project in location designated by the Consultant. Modify sample installation as necessary to obtain acceptance.

.2 Accepted sample installation may remain as part of the completed work.

.3 Remainder of work of this Section shall match the approved sample installation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Keep materials dry, with containers sealed, and protected from weather and other damage. Store materials in heated, dry areas maintained between 15 degree C and 25 degree C.

1.7 PROJECT CONDITIONS

.1 Maintain substrate and ambient temperature at 10 degree C minimum for 24 hours before, during, and 48 hours after application or until cured.

.2 Ventilate work area.

.3 Ensure salts of any kind, from any source, and other contaminants, are not allowed on substrates which are to receive traffic coating system.

1.8 WARRANTY

.1 Submit a five (5) year warranty of materials and workmanship against failure and specifically against leaks, except as the result of structural faults or other causes beyond control of the work of this Section.

.2 Cracks arising from normal shrinkage and/or expansion and contraction of concrete shall not be considered as structural failure. Hairline cracks which result from these causes shall be considered normal and consequently the warranty shall not be voided as a result of such minor defects.

1.9 WARRANTY MAINTENANCE

.1 During the warranty period, carefully inspect the work of this Section together with Owner's representative and applicator, twice yearly during the first year and once a year for duration of the warranty period. Submit typewritten reports to the Owner indicating the condition of the work and defects found, if any.

.2 Make good all defects covered by the warranty at no cost to the Owner. Submit proposal for correction of defects not covered by warranty.

2 Products

2.1 MATERIALS

.1 Traffic Coating (TC): Low VOC, high solids, cold applied elastomeric waterproofed vehicular traffic coating system, consisting of primer, waterproofing base coat, detail coat, wear coat with slip resistant aggregate and standard colour aliphatic polyurethane top coat.

.1 Vulkem 360NF/951NF by Tremco. Polyurethane base coat, polyurethane wear coat, minimum total system dry film thickness exclusive of primer and aggregate, 1mm (40 mil) for parking stalls, 1.27mm (50 mil) for ramps, turning points and driving lanes.

.2 Auto-Gard FC by Neogard. Polyurethane base coat, polyurethane wear coat, minimum total system dry film thickness exclusive of primer and aggregate, 1mm (40 mil) for parking stalls, 1.27mm (50 mils) for ramps, turning points and driving lanes.

.3 Sikalastic Duodeck consists of two components: Sika Duochem 390 base coat and Sika Duochem 391 top coat by Sika Canada. Polyurethane base coat, polyurethane wear coat, minimum total system dry film thickness exclusive of primer and aggregate, 1mm (40 mil) for parking stalls, 1.4mm (56 mils) for ramps, turning points and driving lanes.

.2 Mortar Traffic Topping

.1 Sikafloor Morritex Broadcast System by Sika Canada: Solvent free, high solids, cold applied epoxy mortar and broadcast waterproofed vehicular traffic topping system, consisting of primer, detail coat, base coat with slip resistant aggregate and standard colour top coat.

.3 Aggregate: 20-30 mesh silica or aluminium oxide, minimum hardness of 6 on the Mohs scale.

.4 Sheet Flashing: 1.5mm (60 mil) thick non-staining elastomeric sheet, compatible with traffic coating and acceptable to traffic coating manufacturer.

.5 Sealant: Self levelling sealant as recommended by the traffic coating system manufacturer.

.6 Backer Rod: Closed cell polyurethane.

3 Execution

3.1 PREPARATION

.1 Examine substrates and environmental conditions before commencement of work of this Section. Ensure substrates are sound, free from substances detrimental to bond, are at proper moisture content, and that correct elevations and slopes have been provided.

.2 Prepare substrate as necessary to ensure proper bond and performance of the traffic coating system.

.3 Abrade and clean concrete substrates using a steel shot blast machine which employs an iron-shot and vacuum process, to remove laitance, impurities, and curing and sealing compounds.

.4 Route out and vacuum clean cracks and construction joints in substrates.

.5 Cut 6mm x 6mm (1/4" x 1/4") chase in substrate at any point where termination of traffic coating is subjected to vehicular traffic. Fill chase with sealant.

.6 Mask surfaces neatly and accurately to provide sharp, straight lines for bases.

.7 Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to manufacturer's written recommendations.

.8 Provide sealant cants at penetrations and at deck-to-wall butt joints.

.9 Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

.10 Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.2 APPLICATION - DETAIL WORK

.1 Apply 6mm (1/4") backer rod into juncture of horizontal and vertical surfaces. Apply bead of sealant, tool to form 45 degree cant.

.2 Fill cracks flush and smooth with sealant and let cure before applying membrane.

.3 Cover treated cracks, construction joints and hairline cracks with a minimum DFT 0.75mm (30 mil) thick detail coat, minimum 150mm (6") wide and centred on crack or joint. Detail coat is additional to required base coat thickness.

.4 Let detail coat cure for minimum 24 hours before applying base coat.

.5 Extend waterproofing into deck drains. Make connections watertight.

3.3 APPLICATION – TRAFFIC COATING

.1 Primer: Apply primer to clean and dust-free substrate at rate recommended by traffic coating manufacturer and as required to obtain complete coverage.

.2 Base Coat: Apply base coat to entire area full coverage. Let cure.

.3 Wear Coat: Apply wear coat in multiple applications of equal thickness.

.1 Apply first wear coat over cured base coat. Immediately broadcast aggregate full coverage at minimum rate of 1.5 kg/l (12.5 lb/gal) of wear coat. Backroll aggregate to ensure even distribution.

.2 Increase aggregate coverage for ramps, driving lanes and turning circles.

.3 Allow preceding wear coat and aggregate to cure before application of subsequent coats. Let cure.

.4 Top Coat: Apply required top coat over cured wear course to act as a tie-coat and to seal the surface.

3.4 APPLICATION – MORTAR TRAFFIC TOPPING

.1 Primer: Apply coat of primer to clean and dust-free substrate at rate recommended by traffic topping manufacturer and as required to obtain complete coverage.

.2 Base Coat: Apply base coat to entire area full coverage. Immediately broadcast aggregate to rejection. Let cure.

.3 Top coat: Apply top coat over cured base coat. Let cure.

.4 Installed System Thickness: Minimum 6mm.

3.5 APPLICATION - BASES

.1 Provide traffic coating base at walls, columns, curbs and similar vertical surfaces adjacent to floor coating. Except where otherwise shown or schedule, base shall be 200mm (8") high.

.2 Ensure base substrates are sound and coved. Apply primer and base coat for vertical surfaces as specified above. Extend base coat 100mm (4") onto horizontal surfaces.

.3 Featheredge terminating edge of base coat on horizontal surfaces so it will not show through the subsequent coats.

.4 Apply topcoat over cured base coat, full coverage.

3.6 FIELD QUALITY CONTROL

.1 The Owner may retain and pay for the services of an inspection and testing company, approved by the Consultant, to check the applied thickness of the traffic coating and waterproofing membrane system.

.2 Provide cut test samples and repair cut tests required by the inspection and testing company to the satisfaction of the Consultant.

3.7 CLEANING

.1 Remove surface blemishes from completed surfaces using cleaners and procedures recommended by the traffic coating manufacturer.

.2 Clean and make good surfaces soiled or otherwise damaged as a result of work of this Section. Pay cost of restoring finishes which cannot be satisfactorily restored.

3.8 PROTECTION

.1 Do not pile or store materials on traffic coating, and bar traffic from completed work for a minimum of 12 hours.

.2 Protect surfaces which are not to receive traffic coating from being soiled due to work of this Section.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

- .1 Board insulation including:
  - .1 Foundation and Under slab Insulation Board
  - .2 Concrete Faced Perimeter Insulation Board
  - .3 Mineral Wool Cavity Wall Insulation Board
  - .4 Mineral Wool Insulation for Curtain Wall.
  - .5 Plastic Cavity Wall Insulation Board
  - .6 High Density Under slab Insulation Board
  - .7 Parking Garage Ceiling Insulation Board
- .2 Batt Insulation including:
  - .1 Thermal Batt insulation installed in metal stud cavity in exterior wall assemblies.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 Underwriters Laboratories of Canada (ULC):

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

.3 American Society for Testing and Materials (ASTM):

- .1 ASTM D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- .2 ASTM D2842, Standard Test Method for Water Absorption of Rigid Cellular Plastics

.4 Canadian General Standards Board (CGSB):

- .1 CGSB 71-GP-24M, Adhesive, Flexible for Bonding Cellular Polystyrene Insulation
- .2 CAN/CGSB-37.5, Cutback Asphalt Plastic Cement

.5 Canadian Standards Association (CSA):

- .1 CSA A123.3, Asphalt Saturated Organic Roofing Felt

1.5 SUBMITTALS

.1 Provide submittals in accordance with the General Conditions and Section 01 33 00 – Submittal Procedures.

.2 Product Data: Provide product description, insulation properties, and preparation requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Store insulation materials in dry areas, protected from wetting, sunlight and traffic. Store insulation board flat on a flat surface, and to prevent edge damage and placing of materials on top of stored boards.

.2 Ensure that insulation board and adhesives are stored at a minimum temperature of 4 deg C for twelve (12) hours before installation, and that freezable adhesives are stored only at temperatures above 0 deg C at all times.

2 Products

2.1 MATERIALS

.1 Foundation Insulation Board:

.1 Extruded expanded polystyrene meeting CAN/ULC S701, Type 4, minimum RSI value of 0.88 per 25 mm thickness (R value of 5 per inch). Minimum compressive strength of 206 kPa.

.1 Styrofoam brand SM, by Dupont Canada.

.2 Foamular C-300, by Owens-Corning Canada.

.3 GreenGuard GG30-LG XPS by Kingspan Canada.

.2 Under slab Insulation Board:

.1 Extruded polystyrene meeting CAN/ULC S701, Type 4, minimum RSI value of 0.88 per 25 mm thickness (R value of 5 per inch). Minimum compressive strength of 275 kPa.

.1 Foamular 400 by Owens-Corning Canada.

.2 Styrofoam HIGHLOAD 40 by Dupont Canada.

.3 GreenGuard GG40-LG XPS by Kingspan Canada.

.3 Concrete Faced Perimeter Insulation Wall Panel Board:

.1 Perimeter Foundation Insulation: Extruded polystyrene board to ASTM C578 (CAN/ULC-S701) Type IV, rigid, closed cell, with integral high density skin, complete with integral 8mm (5/16”) thick latex-modified concrete facing.

.2 Board Size: 610mm x 1220mm x 59mm (24” x 48” x 2-5/16”).

.3 Edges: Tongue and groove sides, square edge ends.

.4 Thermal Resistance (ASTM C 518): Long term aged R-value of 5/1” (0.03 sm K/W / 1mm).

.5 Products:

.1 WallGUARD Concrete Faced Insulated Perimeter Wall Panels by T. Clear Corp.

.2 Concrete Faced Insulation Wall Panels (CFI) by Tech-Crete Processors Ltd.

.4 Semi-Rigid Insulation: Mineral Wool Board Insulation for exterior wall cavity behind cladding, CAN/ULC-S702 Type 1 or ASTM C612 Type IVB, mineral rock or slag fibre semi-rigid board, conforming to the following:

.1 Board Density: 65 kg/cu m.

.2 Water Vapour Permeance: 1555 ng/Pa s.sq. m.

.3 Minimum Thermal Resistance: RSI of 0.75 per 25.4 mm thickness.

.4 Board Size: 600 x length to suit space.

.5 Board Thickness: As indicated.

.6 Facing:

.1 Unfaced unless otherwise noted.

.2 Where Black facer is indicated, provide “32# Manniglas -1882 Black” factory applied facer by Lydall or approved equivalent.

.7 Board Edges: Square.

.8 Flame/Smoke Properties: 0 / 0, in accordance with CAN/ULC-S102.

.9 Acceptable Products:

.1 ‘CavityRock’ manufactured by Rockwool,

.2 ‘Rainbarrier 45’ manufactured by Thermafiber.

.5 Semi-Rigid Insulation: Mineral Wool Board Insulation for Curtain Wall spandrel panels, CAN/ULC-S702 Type 1 or ASTM C612 Type IVB, mineral rock or slag fibre semi-rigid board, conforming to the following:

.1 Board Density: 56 kg/cu m.

.2 Water Vapour Permeance: 1.807 ng/Pa s.sq. m.

.3 Minimum Thermal Resistance: RSI of 0.74.

.4 Board Size: 600 x length to suit space.

.5 Board Thickness: As indicated.

.6 Facing: Unfaced.

.7 Board Edges: Square.

.8 Flame/Smoke Properties: 0 / 0, in accordance with CAN/ULC-S102.

.9 Acceptable Products:

.1 ‘Curtain Rock’ manufactured by Rockwool,

.2 ‘MinWool Curtainwall’ by Johns Manville

.3 ‘Versaboard’ manufactured by Thermafiber,

.6 Plastic Cavity Wall Insulation Board:

.1 Polystyrene, extruded type, in accordance with CAN/ULC S701, Type 3, thermal resistance not less than RSI 0.87/1”; square edges, board size 406mm x 2.4m (16” x 8’) x thickness required to achieve insulation value indicated on Drawings; minimum compressive strength 170 kPa at 10% deformation in accordance with ASTM D1621-10, water absorption (% by volume) maximum 0.7% in conformation with ASTM D2842-06:

.1 Product:

.1 Dow Styrofoam CavityMate.

.2 Owens-Corning Foamular CW25.

.7 High Density Under slab Insulation Board:

.1 Closed-cell, cellular, foamed, smooth skin, extruded expanded polystyrene, having [40][60][100] psi compressive strength, thicknesses as indicated on drawings and specified herein, conforming to CAN/ULC S701, Type IV.

.1 Basis of Design Materials:

.1 Styrofoam [HI-40][HI-60][HI-100] Extruded Polystyrene Insulation by Dow Chemical Canada Inc.

.2 Foamular [400][600][1000] Extruded Polystyrene (XPS) Rigid Foam Insulation by Owens-Corning Canada Inc.

.2 Provide high density under slab insulation board with ship lapped edges.

.8 Parking Garage Ceiling Insulation Board:

.1 Faced, non-combustible, rigid, mineral wool fire rated insulation board to ASTM C612, Type IVB.

.1 Non-combustibility: To CAN/ULC S114.

.2 Compressive resistance:

.1 At 10 %: 16.9 kPa to ASTM C165.

.2 At 25 %: 28.1 kPa to ASTM C165.

.3 Size: 610mm x 1219mm.

.4 Thickness: 50mm, unless otherwise indicated on the Drawings.

.5 Facer: Aluminum foil with fiberglass (RFF) reinforcement to ASTM.

.6 Basis of Design Material: ROCKBOARD 60 with RFF Facer by Rockwool

.9 Thermal Batt Insulation: Mineral wool batt insulation, CAN/ULC-S702 Type 1, density 32 kg/m^3 (2 lb/ft^3) fibre, thickness and thermal resistance value as indicated.

.1 Comfortbatt by Rockwool.

.2 Ultrabatt by Thermafiber,

.3 TempControl Batts by Johns Manville.

2.2 ACCESSORIES

.1 Insulation Fasteners:

.1 Mechanical Fasteners: High quality, impact resistant plastic fastener system specifically designed for installation of board insulation materials; 38mm (1-1/2") diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate.

.2 Insulation Clips: Impale type, perforated 50mm x 50mm (2" x 2") cold rolled carbon steel 1mm (1/32") core metal thickness, adhesive back; 1.6mm (1/16") diameter annealed steel wire spindle, length to suit insulation, 25mm (1") diameter self locking washers.

.3 Perimeter Insulation Fasteners: Concrete faced insulation manufacturer's standard concealed fasteners with groove mounting plate and fastening spline.

.2 Adhesive:

.1 Trowelable Polystyrene Insulation Adhesive: Trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation in accordance with

CGSB 71-GP-24M; suitable for application to temperature of -10 deg C or lower, as approved by insulation board supplier.

.3 Felt Slip Sheet: No. 15 asphalt saturated, organic, unperforated felt conforming to CSA A123.3.

.4 Slip Sheet Mastic: Cut back asphalt plastic cement conforming to CAN/CGSB-37.5.

.5 Protection Board: Pre-moulded, semi-rigid asphalt/fibre composition board, minimum (¼") 6mm thick, formed under heat and pressure as recommended by board insulation manufacturer for below grade installations.

.6 Air Barrier:

.1 6 mils thick clear polyethylene sheet conforming to CAN/CGSB-51.34.

.7 Polyethylene Adhesive Tape:

.1 'Scotch Brand No.483' manufactured by 3M Company.

3 Execution

3.1 EXAMINATION

.1 Before commencing work, ensure that all surfaces to which perimeter insulation board is applied are clean, reasonably smooth with no abrupt changes in plane, free of grease, and with protruding fins of mortar or concrete removed, and that the surfaces are otherwise acceptable for insulation application as specified.

3.2 PREPARATION

.1 Clean substrates of substances harmful to insulations; remove projections that interfere with insulation attachment.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

.1 Install insulation and accessories in accordance with manufacturer's written instructions applicable to products and application indicated and as follows:

.1 Use insulation that is undamaged, dry, and unsoiled.

.2 Maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements, and as follows:

.1 Saw cut and trim insulation neatly to fit spaces; fill voids with foamed-in-place insulation compatible with installed insulation.

.2 Butt edges and ends tight

.3 Fit insulation tight against mechanical, electrical and other items protruding through the plane of insulation

.4 Use insulation free of broken or chipped edges

.5 Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise specifically shown or required to make up total thickness

.6 Fit insulation firmly against substrate using mechanical fasteners spaced in accordance with manufacturers recommended spacing and pattern; in addition, adhere insulation to uneven substrate surfaces and provide additional fasteners to eliminate air spaces between insulation and substrate

.7 Mechanically fasten insulation boards 50mm (2") in from edges at 305mm (12") centers

.2 Leave insulation joints unbonded over line of expansion and control joints; bond a continuous 150mm (6") wide strip of primary vapour membrane over expansion and control joints using compatible adhesive

.3 Protect insulation from damage until it is covered; replace any broken, sunburned, crushed or dented insulation immediately prior to covering; coordinate with back-filling operations

.4 Board Insulation: Install board insulation to vertical surfaces with adhesive applied in accordance with manufacturer's written instructions, and as follows:

.1 Exterior Application: Extend boards as indicated on Drawings to top of footing, installed on exterior face of perimeter foundation wall.

.2 Apply adhesive to the substrate by the "dab" method not less than 9.5mm x 19m (3/8" x 3/4") size at 150mm (6") centers; bed the insulation in the adhesive before the adhesive loses its tack or skins over.

.3 Protect below grade insulation on vertical surfaces from damage during backfilling by applying protection board; set in adhesive according to insulation manufacturer's written instructions.

.4 Secure insulation mechanically and cover insulation with parging and metal lath as specified in Section 04 20 00 – Masonry where insulation extends above grade, and concrete faced insulation is not supplied.

.5 Concrete Faced Perimeter Insulation:

.1 Layout concrete-faced insulation boards to maximize board sizes. Do not use boards less than 152mm (6") wide.

.2 Install concrete faced insulation board system in orientation as indicated or to maximize full sheets. Complete with fastening clips and cap flashing in accordance with manufacturer's installation guidelines.

.6 Foundation and Under Slab Insulation: Extend boards [a minimum of 1m (4') in from perimeter foundation wall] [as indicated on Drawings], and as follows:

.1 Lay boards on level compacted fill.

.2 Insulate structural slabs at entrances with insulation placed horizontally underneath the concrete, and insulate surrounding slabs on grade in the same way for a distance of 1m (4') in every direction from the perimeter of the structural slab; omit perimeter insulation on adjacent foundations for the width of the structural slab.

.7 High Density Under Slab Insulation: Install in accordance with manufacturer's written instructions, and as follows:

.1 Install board insulation horizontally on level compacted fill [and within driveway ramps] [to locations indicated on Drawings].

.8 Cavity Wall Insulation: Fit courses of insulation between wall ties and other confining obstructions in cavity; butt edges tightly in vertical and horizontal directions and as follows:

.1 Install cavity insulation with a tight fit to substrate materials, provide adhesive and additional fasteners where uneven substrates cause air spaces behind insulation; apply adhesive to substrate in a continuous film not less than 3mm (1/8") thick when wet and bed the insulation into adhesive before adhesive loses its tack or skins-over.

.2 Apply insulation fasteners using a minimum of six (6) fasteners in two rows located near the centre of the board along the narrow dimension and near the third points along the long dimension; secure boards with two clips at the centre where both dimensions are less than 610mm (24").

.3 Coordinate application of cavity wall insulation with installation of masonry ties and anchors specified in Section 04 20 00 – Masonry.

.4 Apply sheet membrane vapour retarder behind Z-bars prior to installation of insulation between Z-bars supporting preformed metal cladding.

.5 Install insulation clips to walls before sheet membrane air barriers are applied.

.9 Semi-Rigid Insulation: Mineral Wool Board Insulation for Curtain Wall spandrel panels

.1 Install curtain wall in accordance with curtain wall system manufacture recommendations, and as indicated in Section 08 44 13 - Glazed Aluminum Curtain Wall.

.10 Parking Garage Ceiling Insulation: Install in accordance with manufacturer's written instructions, and as follows:

.1 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.2 Keep insulation minimum 75mm from heat emitting devices such as recessed light fixtures, and minimum 50mm from sidewalls of vents.

.3 Install insulation board using all-purpose construction adhesive and mechanical fasteners, in accordance with insulation manufacturer's written recommendations.

.4 Seal joints with acoustical joint sealant in accordance with Section 07 92 00 – Sealants.

3.4 BATT INSULATION

.1 Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

.2 Metal Framing: Place membrane air barrier on warm side of insulation; lap and seal sheet air barrier joints over member face.

.3 Tape seal tears or cuts in membrane air barrier.

.4 Install continuous vapour barrier, overlapping adjacent surfaces including self-joints a minimum of 50mm (2") and seal with specified tape. Applications to form a complete vapour seal.

3.5 PROTECTION

.1 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.

.2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of self-adhered air and vapour membranes that prevent exfiltration and infiltration between interior and exterior of building through wall and roof transition construction.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing of Materials (ASTM):

.1 ASTM E96/E96M-10, Standard Test Methods for Water Vapour Transmission of Materials.

.2 ASTM E2178-11, Standard Test Method for Air Permeance of Building Materials.

1.4 DEFINITIONS

.1 Air Vapour Barrier Material: A primary element that provides a continuous barrier to the movement of air.

.2 Air Vapour Barrier Accessory: A transitional component of the Air Vapour Barrier that provides continuity.

.3 Air Vapour Barrier Assembly: The collection of Air Vapour Barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Conference:

.1 Convene a pre-installation conference two (2) weeks prior to commencing work of this section. Require attendance of parties directly affecting work of this section, including, but not limited to, the Owner’s representative, Consultant, General Contractor, air and vapour barrier membrane contractor, air and vapour barrier membrane manufacturer's representative and substrate installer.

.2 Contact Consultant two (2) weeks prior to pre-installation conference to confirm schedule.

.3 Review preparation and installation procedures and co-ordinating and scheduling required with related work.

.4 Record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to the vapour permeable air barrier membrane, including the following:

.1 Tour, inspect and discuss condition of substrate, penetrations and preparatory work performed by other trades.

.2 Review surface preparation, minimum curing period and installation procedures.

.3 Review special details and flashings.

.4 Review required submittals, both completed and yet to be completed.

.5 Review and finalize construction schedule related to work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

.6 Review required inspections, testing, protection and repair procedures.

.7 Review weather and forecasted weather conditions, and procedures for coping with unfavourable conditions.

.2 Coordination: Coordinate interface of membranes specified in this Section with adjacent systems to ensure continuity of system and that junctions between various components are effectively sealed; verify with manufacturers and installers for installation procedures of materials incorporated into air and vapour membrane elements including membranes, transitions, coatings and sealants and continuity with roofing membrane.

1.6 SUBMITTALS

.1 Provide submittals in accordance with the General Conditions and Section 01 33 00 – Submittal Procedures.

.2 Action Submittals:

.1 Product Data: Submit manufacturer's product literature, and installation instructions required for complete and proper installation of air and vapour retarder elements including membranes, primers, fasteners, proprietary application equipment, etc.

.2 Samples: Submit representative sample of air and vapour membrane minimum 305mm x 305mm (12" x 12") with factory applied identification clearly visible.

.3 Safety Data Sheets:

.1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on site for reference by workers.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer: Obtain air and vapour membrane materials through one source from a single manufacturer or using materials from a secondary source that are acceptable to the manufacturer.

.2 Installer: Use an installation company that is acceptable to the manufacturer, using workers who are trained and approved by the membrane manufacturer having experience with projects of similar complexity and area.

1.8 ENVIRONMENTAL CONDITIONS

.1 Air and vapour barrier is not to be applied to surfaces that are either wet, oily, frosted, dirty or contaminated in any way.

.2 Ambient Conditions: Apply air and vapour membrane to substrate surfaces that are within manufacturer's installation temperature threshold range accounting for wind cooling and apparent temperature when actual temperature is approaching manufacturer's minimum temperature threshold.

.3 Air and vapour barrier is not to be applied over lightweight cast-in-place concrete containing high moisture or certain curing compounds. Cast-in-place concrete should be cured for a minimum of two weeks prior to application of air barrier membrane.

1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries with construction schedule and arrange for proper storage areas.

.2 All materials are to be stored in a clean, dry and protected area in their original containers sealed and undamaged. Manufacturer's labels are to be easily visible and undamaged.

.3 Care and precaution are to be exercised by the applicator so as not to damage the work of other trades. Applicator is responsible to take all necessary precautions to protect work of other trades during application.

.4 In addition to the above, store modified bituminous sheet type air and vapour barrier membrane as follows:

.1 Store rolls of membrane on end, in vertical position without leaning with selvage end up.

.2 Store materials away from direct heat or open flame.

.3 For installation in cold weather, store rolls of membrane in heated storage trailer for minimum of 24 hours with the temperature kept at 21 deg C and remove for application with as little exposure as possible to low ambient temperatures.

.5 Provide portable fire extinguishers within easy access of torching applications.

1.10 WARRANTY

.1 Manufacturer’s Warranty: Submit manufacturer's warranty stating that air and vapour membranes and accessories are free of defects and are manufactured to meet manufacturer's published physical properties and material specifications as of the date of product delivery.

.2 Installer’s Warranty: Submit installers warranty stating that air and vapour membranes and accessories are installed in accordance with manufacturer's recommendations and that membrane, transitions and through-wall flashing membranes, primers, mastics, adhesives and sealants are sourced from one manufacturer.

2 Products

2.1 MATERIALS – GENERAL

.1 Source Limitations: Obtain primary air vapour barrier (AVB) materials and air vapour barrier accessories from single source from single manufacturer.

2.2 AIR VAPOUR BARRIER (AVB) – SELF ADHESIVE SHEET MATERIALS

.1 Self-Adhesive Modified (Rubberized Asphalt) Bitumen Sheet Membrane:

.1 Field membrane, transition membrane and flashings (through wall flashings)- Self-adhering membrane of rubberized-asphalt 0.8 mm integrally bonded to high density, cross-laminated polyethylene film 0.1 mm, formed into uniform flexible sheets of not less than 1 mm total thickness, interleaved with disposable silicone-coated release paper until installed. Use regular or low-temperature variety for temperature ranges specified by manufacturer. All related accessories such as primer, seam tape, mastic, fluid, and sealant shall be as recommended by, or provided by the same manufacturer as the air/vapour barrier material used.

.1 Thickness: 1.0 mm (40 mils).

.2 Air leakage: ASTM E283 - <0.01 L/s·m² @ 75 Pa.

.3 Water vapour permeance: ASTM E96 - 2.8 ng/Pa.m².s (0.05 perms).

.4 Low temperature flexibility: -30°C.

.5 Elongation: ASTM D412 - modified -200%.

.2 Manufacturer: Subject to conformance with the requirements of this Section, provide the following products by Henry Company Canada / Bakor, or an acceptable equivalent products named below:

.1 Self-Adhering Air/Vapour Barrier: 'Blueskin SA' and 'Blueskin LT'.

.2 Flashings: 'Blueskin TWF'.

.3 Acceptable Equivalent Products:

.1 'Sopraseal Stick 1100T' summer grade / winter grade by Soprema.

.2 'ExoAir 110/110LT' by Tremco.

.3 'Air Shield/Air Shield LT' by W.R. Meadows Inc.

.4 Substitutions: Not Permitted.

.2 Self-Adhesive Elastomeric Film Air Vapour Barrier Membrane:

.1 Self-adhered multilayer elastomeric film membrane with high tack acrylic adhesive.

.1 Thickness: 0.25 mm (10 mils).

.2 Air leakage: ASTM E283-91- <0.01 L/s·m² @ 75 Pa.

.3 Water vapour permeance: ASTM E96 - 8 ng/Pa.m².s (0.14 perms).

.4 Low temperature flexibility: ASTM D1970 -30°C.

.5 Elongation: ASTM D882 - 700%.

.2 Manufacturer: Subject to conformance with the requirements of this Section, provide the following products by 3M Canada:

.1 Self-Adhering Air/Vapour Barrier: 'Air and Vapour Barrier 3015'.

.2 Flashings: '3015TWF'.

.3 Acceptable Equivalent Products:

.1 Substitutions: Not Permitted.

.3 Accessories: Furnish auxiliary materials recommended by manufacturer for intended use and compatible with air vapour barrier (AVB) membrane.

.1 Flashing to counter flash metal flashings refer to Section 07 62 00 – Prefinished Metal Flashing and Trim.

.2 AVB Transition Strip: Peel and stick membrane to transition between membranes.

.3 Primer: If required and as recommended by membrane manufacture for approved substrate, VOC compliant.

.4 Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes by membrane manufacturer.

.5 Termination bars and fasteners: Galvanized steel, Stainless steel and stainless fasteners.

3 Execution

3.1 EXAMINATION

.1 Ensure that surfaces to receive air barrier membrane are dry, firm, suitable for bond, and free from dust, dirt, loose material, projections, ice, frost, slick, grease, oil or other matter detrimental to bond of sheet type air barrier membrane.

.2 Report surfaces left unacceptable by other trades in writing to the Consultant before commencing installation.

.3 Co-ordinate work of this section with the work of other sections.

.4 Commencement of work of this section implies acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Prepare surfaces in accordance with manufacturer's written requirements for type of substrate; free from voids, spalled areas, loose aggregates or sharp points; clean surfaces to remove contaminants that could affect bond such as grease or wax, dust, dirt and debris.

.2 Apply primer to substrates when required by manufacturer at rate recommended by manufacturer; cover primed substrates on same day, reapply primer when work cannot be completed on the same day.

3.3 INSTALLATION

.1 Install air and vapour barrier membranes in accordance with manufacturer's written requirements, using appropriate equipment and skilled workers and as follows:

.1 Transition Membranes: Connect air and vapour membranes to adjacent assemblies having pre-installed transition membranes; install transition membranes where required to maintain continuity of building envelope.

.2 Through Wall and Flexible Flashings: Install flexible membranes where required to maintain flow direction to divert water away from face of building envelope.

.2 Separate air and vapour barrier membranes from incompatible materials, and provide manufacturer's recommended transition materials required to maintain continuity of building envelope.

.3 Cut and tightly seal air and vapour barrier membrane around penetrations and protrusions to provide a continuous air barrier.

.4 Lap joints in air and vapour barrier membrane minimum of 75mm (3").

.5 Where masonry anchors and supports pass through air and vapour barrier membrane, ensure continuity of air and vapour barrier membrane by applying air barrier mastic all around/over masonry anchors.

.6 Prior to masonry being installed by Section 04 20 00 – Masonry, inspect air and vapour barrier membrane for punctures, misaligned seams and fishmouths. Apply additional layer of air and vapour barrier membrane over damaged/affected areas, extending membrane minimum of 152 mm (6") beyond damage in all directions.

3.4 SITE QUALITY CONTROL

.1 Allow access for review and inspection and testing of installed air and vapour barrier membrane, and repair of deficiencies before placement of insulation materials.

.2 Manufacturer's Site Services: Arrange for air and vapour barrier membrane manufacturer's technical personnel to review building envelope during installation.

.3 Owner reserves the right to engage a testing firm to perform air and vapour barrier membrane testing to confirm performance of installed membranes and insulation systems in accordance with Section 01 45 00; testing will be performed when the building mechanical systems are balanced and operating; when building is occupied and climatic conditions are suitable for infrared thermographic scan of the building.

.4 Cooperate with testing agency; repair or replace air and vapour barrier membrane as directed by testing agency, at no additional cost to the Owner.

3.5 CLEANING AND PROTECTION

.1 Protection: Protect membrane as recommended by manufacturer from effects of long term exposure where membrane is open to the environment for prolonged time periods using opaque plastic sheets or tarpaulins; protect membrane from penetrations and damage by successive components of the Work; assign payment for repairs to responsible parties; make repairs in accordance with manufacturer's written instructions using original installers.

.2 Cleaning: Remove masking materials, debris, excess materials and equipment from site at completion of the work; conduct ongoing daily cleaning as directed by the Contractor; clean stains, drips or spills of coatings, sealants, mastic or primers visible on finished surfaces.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Provision of preformed aluminum panel work, including fabrication and erection, by manufacturer or his authorized fabricator/erector.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings showing construction and anchorage of preformed aluminum panel cladding and soffits including, details of all elements of assembly and construction.

.2 Related items shown on shop drawings which are not intended to be supplied as part of the work of this Section, shall be so identified. All dimensions shall be clearly noted and methods of fastening and anchoring detailed. Show accurately and identify all adjacent materials.

.3 Do no fabrication work until shop drawings are approved by the Consultant.

.2 Design Calculations:

.1 Submit design calculations.

.2 Design calculations shall include all test reports and other pertinent supporting data.

.3 Submit design calculations at the same time as shop drawings.

.3 Samples:

.1 Submit 305 mm x 305 mm (12" x 12") samples showing finishes and profiles for Consultant's approval.

.4 Maintenance Data:

.1 On completion of work of this Section, supply maintenance instructions for insertion into Operating and Maintenance Manual.

1.4 DESIGN REQUIREMENTS

.1 Design, fabricate and install preformed aluminum panels, free of defects in material and workmanship affecting appearance and performance.

.2 Employ engineering staff experienced in the design, fabrication and erection methods of preformed aluminum panels and support system design.

.3 Assume responsibility for the adequacy of designs, proper provision for and use of all proprietary materials and components from other suppliers forming part of the work of this Section.

.4 Design preformed aluminum panels and support system accommodate anticipated thermal movement of the building structure. Include expansion joints to accommodate movement in panel system, and between panel system and structure caused by structural movements without permanent distortion, or damage to panels, or racking of joints, or breakage of seals or water infiltration and penetration in any form.

.5 Design pattern of joints in preformed aluminum panels to strictly follow pattern as indicated on drawings. Where panel sizes indicated exceed economical panel sizes, provide intermediate concealed "hairline" joints.

.6 Design preformed aluminum panel support/mounting system to be non-progressive type, allowing removal of any individual panel without requiring removal of adjacent work of other Sections and without causing damage to adjacent work of other Sections. Design preformed aluminum panel support/mounting system to be resistant against unauthorized removal of panels.

.7 Design preformed aluminum panels and support system to withstand wind loads and temperature range expected in the geographical area for this project, under the National Building Code - latest edition, Appendix 'C' climatic information for 30 year probability without any detrimental effects on appearance and performance and maximum allowable deflection of 1/180 of span.

1.5 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any areas beyond the design limits.

.2 Handle and store materials in accordance with manufacturer's recommendations.

.3 Provide dry storage areas. Protect panels and panel system materials from damage.

.4 Adequately protect and crate all components against damage, dirt, disfigurement and weather.

.5 Exercise extreme care in handling units to prevent damage and scratched surfaces.

.6 Cover and protect the Work of other trades in the area of work from damage. Make good all damage to the satisfaction of the Consultant.

.7 Be responsible for damage to the Work until the building is complete and accepted by the Owner. In case of damage, material shall be completely removed and replaced with new.

.8 Provide safe and adequate equipment on the site to execute the work, hoisting, scaffolding, staging, safety protection equipment, tools, plant and other equipment required for the completion of the Work.

1.6 WARRANTY

.1 Warrant the Work of this Section in accordance with General Conditions but for an extended period of two (2) years and agree to repair or replace faulty materials or work which becomes evident during the warranty period without cost to the Owner.

2 Products

2.1 APPROVED SYSTEMS AND MANUFACTURERS

.1 Emburite II by Kastner Metals Embury Company.

.2 Kanalco Panel System by Kanalco Inc.

2.2 MATERIALS

.1 Aluminum Sheet:

.1 Minimum 3mm (1/8") thick AA3105-H14 alloy conforming to ASTM B209, with special hardness for flat panels and anodizing quality.

.2 Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off" marks or other blemishes, whether left unfinished or finished.

.2 Welding Materials:

.1 Conforms to CSA W59.2.

.3 Hanging System:

.1 Concealed type as designed by manufacturer and approved by Consultant.

.4 Sealant:

.1 Multi-component type, 'Dymeric 240FC' by Tremco (Canada) Ltd., conforming to ASTM C920. Colour selected later by Consultant from manufacturer's standard range.

.5 Joint Back-Up:

.1 Round open cell foam, extruded polyethylene, Shore A hardness of 20, tensile strength 140 to 200 kPa, outsized 30-50% compatible with sealant and primer, non-adhering to sealant. 'Ethafoam ' by Dow Chemical Canada Inc. or approved equal.

.6 Joint Cleaner and Primer:

.1 As recommended by sealant manufacturer.

.7 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.8 Butyl Tape:

.1 Extruded, high grade macro-polyisobutylene tape of width and of shore hardness to suit conditions.

2.3 FABRICATION

.1 Maximum allowable panel tolerances to be as follows:

.1 Panel bow: 0.2% of panel dimensions up to 5 mm (0.1875") maximum.

.2 Width or length: ±1 mm up to 1219 (0.032" up to 48"), ±2 mm (0.064") from 1219 mm to 3658 mm (48" to 144").

.3 Squareness: 5 mm (0.1875") difference between diagonal measurements.

.4 Camber: 1 mm (0.032").

.2 Form all panels to specified dimensions with tolerances to accommodate expansion and contraction between panels and support system when subjected to surface temperatures between -34°C to 82°C. Radii of curved panels to be accurately formed in manufacturer's plant. Reinforce back of panels as required with concealed reinforcing.

.3 Weld and grind smooth all panels corners prior to finishing. Weld aluminum by electric arc process in accordance with CSA W59.2.

.4 Factory fabricate accessory and trim components, ready for installation.

.5 Provide "hairline" joints where panels abut adjacent panels as indicated on drawings.

.6 Fit joints and intersecting members accurately in true planes, square, plumb, straight with tight joints and intersections.

.7 Fabricate, drill and tap members to accommodate attachments, anchorage and work of other Sections where located and directed by them.

.8 Provide weep holes as required, at low end of panels to facilitate drainage of condensation and runoff water, in case joint seals fail in panels.

2.4 FINISHES

.1 Clear Anodizing (Architectural Class II):

.1 All aluminum surfaces exposed in the finished work to have integral clear anodic coating, minimum 0.4 mils thickness, and conforms to Aluminum Finish Designation AA-M12C22A31, Architectural Class II.

.2 All concealed aluminum shall have mill finish.

.3 Steel Support System (Concealed):

.1 Hot-dip galvanized in accordance with CAN/CSA-G164-M92 (R2003), with minimum coating of 2 oz./sq.ft., or zinc rich paint.

.4 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.

3 Execution

3.1 INSPECTION AND PREPARATION

.1 Surfaces to receive panel system shall be even, smooth, sound, clean, dry and free from defects.

.2 Take field measurements from actual structure and verify prior to commencement of fabrication.

.3 Allow for dimensional tolerances and deviations from true planes permissible in the structural frame. Excessive deviations shall be reported to the Consultant in writing for correction. Commencement of work of this Section implies acceptance of all surfaces and conditions.

3.2 INSTALLATION

.1 Panel system shall be installed by panel fabricator's authorized erectors in accordance with instructions of panel fabricator and in accordance with shop drawings approved by the Consultant to locations indicated on drawings.

.2 Isolate contact surfaces to prevent electrolysis due to metal to metal contact or contact between metal and concrete or masonry. Use bituminous paint, butyl tape or other means approved by Consultant.

.3 Fabricator/erector shall be responsible for installation.

.4 Co-ordinate with work of other Sections for anchorage/suspension system.

.5 Be responsible for site measurements.

.6 Clean and prime panel joints as recommended by sealant manufacturer.

.7 Install joint back-up material and sealant to panel joints as recommended by sealant manufacturer.

3.3 CLEANING

.1 Remove debris and surplus materials resulting from work of this Section, from the Site upon completion of work of this Section.

.2 Clean dirt, soil and misplaced sealants from preformed aluminum panel system with recommended cleaners and solvents.

.3 Immediately prior to final cleaning and before handing over building to the Owner, make good all damage and disfigurement. Remove all protective films/coatings, stains and foreign matter, and leave in uniform colour and in first-class condition, to Consultant's satisfaction.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Work of this section include the supply and installation of a conventional SBS Modified Bituminous Membrane Roofing system, accessories, and site quality control as indicated in this section.

1.3 RELATED REQUIREMENTS

.1 Section 05 50 00 – Miscellaneous Metals

.2 Section 06 10 00 – Rough Carpentry

.3 Section 07 62 00 – Prefinished Metal Flashing and Trim

.4 Section 07 92 00 – Sealants

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standard.

.2 Canadian Roofing Contractors' Association (CRCA):

.1 Roofing Specification Manual

.3 Provincial Roofing Contractors Association Roofing Specification Manual

.4 American Society for Testing and Materials (ASTM):

.1 ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

.2 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials

.5 Canadian General Standards Board (CGSB):

.1 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing

.2 CGSB 37-GP-64M, Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-up Roofing

.3 CAN/CGSB-37.5, Cutback Asphalt Plastic Cement

.4 CAN/CGSB-37.28, Reinforced, Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and Waterproofing

.5 CGSB 37-GP-9Ma, Primer, Asphalt, Unfilled, for Asphalt Roofing, Damp proofing or Waterproofing

.6 Canadian Standards Association (CSA):

.1 CSA A123.4, Asphalt for Constructing Built-up Roof Coverings and Waterproofing Systems

.2 CSA B111, Wires, Nails, Spikes and Staples

.7 Underwriters Laboratories Canada (ULC):

.1 CAN/ULC S107, Methods of Fire Tests of Roof Coverings

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

.3 CAN/ULC S702, Standard for Mineral Fibre Thermal Insulation for Buildings

.4 CAN/ULC S704, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced

1.5 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit copies of membrane manufacturers current technical data sheets describing the physical properties and recommended installation procedures.

.2 Shop Drawings:

.1 Submit sloped insulation manufacturer's proposed roofing diagrams and layouts for review by the Consultant.

.2 Submit membrane manufacturer's standard details that will be used for this project, indicate changes that must be made to make the details project specific for review by the Consultant.

.2 Informational Submittals: Certificates: Provide roofing system materials that are compatible with building air and vapour retarders specified under Section 07 27 13 – Self-Adhered Air and Vapour Barrier Sheet Membrane.

1.6 SYSTEM PERFORMANCE

.1 General Performance: Installed membrane roofing shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

.2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

.3 Minimum Adhesion of Each Material: 1 MPa.

.4 Fire Hazard and Windstorm Requirements:

.1 Provide membrane roofing, base flashings, and component materials equivalent to requirements in as part of a membrane roofing system and as follows:

.1 Fire Hazard Classification: CAN/ULC-S107, Class C.

.2 Roof Assembly wind uplift requirements: tested in accordance with [latest edition of]CSA A123.21[-20], Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.

.5 Expected Service Life: CSA S 478; Provide a fully adhered roofing system whose cap sheet and cap sheet flashings have a predicted service life of a minimum of 20 years in accordance with requirements of Part 7 of CSA S 478.

.6 Thermal Resistance of Insulation: Minimum effective thermal resistance as indicated in accordance with CAN/ULC-S770-3 - LTTR testing and the following:

.1 Do not include other system componentry such as air surface films, structural materials, membranes, tapered insulation, roof sheathing component contributions in the calculation.

.7 Roof slope: Minimum 2% slope to drain.

1.7 QUALITY ASSURANCE

.1 Obtain roofing membrane materials through one source from a single manufacturer and install using workers who are trained and approved by the roofing membrane manufacturer; maintain a full time experienced journeyman roofer, and at least one apprentice per crew on the Work at all times.

.2 Roofing and sheet metal work will be performed in conformance with the roofing manufacturer's written recommendations using materials that meet the requirements of CAN/ULC S107 to obtain a Class A fire resistance rating; submit proof that roofing materials meet required performance when requested by the Consultant.

.3 Conform to Roofing Specifications as published by Canadian Roofing Contractors Association (CRCA) and local provincial roofing contractors association of the project as a reference.

.4 Perform the work of this Section by a company which has a minimum of five (5) years of proven satisfactory experience in the Work of this Section.

.5 Execute work of this section using an applicator approved by the roofing membrane manufacturer.

1.8 FIRE PROTECTION

.1 Protect roof junctions at parapets, roof curbs and upstands with a fire-resistant tape or barrier to prevent combustible materials within assemblies from ignition arising from the use of torches. Install prior to installation of base sheets.

.2 Use a heat detector gun to spot any smouldering or concealed fire at the end of each work day. Establish a minimum one (1) hour fire watch after torch application.

.3 Do not apply torch directly to dry or unprotected wood surfaces.

.4 Maintain a clean site and have one approved ABC fire extinguisher within 6 meters of each roofing torch. Respect all safety measures described in manufacturer’s technical data sheets. Do not place torches near combustible or flammable products.

1.9 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Deliver materials to the job site; handle and store in original packages and containers with manufacturer's seals and labels intact. The manufacturer's name, brand, mass, specification number and lot number must be shown on the labels.

.2 Store materials in weatherproof shelters having floors that will protect the materials from moisture. Store materials on end. Avoid prolonged exposure of light or heat sensitive materials to sunlight.

.3 Do not store materials on roof in concentrations that exceed design live load.

.4 Place plywood runways over the Work to enable the movement of materials and other traffic during construction of roofing.

.5 Protect surrounding surfaces against damage from roofing work. Where hoisting is necessary, hang tarpaulins to protect walls during delivery of materials from ground to roof.

.6 In the event of materials damage by the elements, improper handling or other causes, such materials will be rejected and will be replaced at no extra cost to the Owner. Remove rejected materials promptly from the site.

.7 During roofing work, exposed surfaces of finished walls must be protected with tarp to prevent damage. Contractor shall assume full responsibility for damage.

1.10 PREINSTALLATION MEETING

.1 Include the roofing manufacturer's representative, roofing contractor's representative, the roofing inspector, the Contractor, the Consultant and Owner.

.2 The purpose of this meeting is to review installation conditions particular to this project and review materials specified in this section.

.3 The roofing inspector will complete the minutes and prepare a report for this meeting.

1.11 SITE CONDITIONS

.1 Minimum ambient application temperature shall not be less than -20 deg C. Notify Consultant and roofing inspector where installation is required below stated minimum temperature and submit manufacturer's standard cold weather installation practices prior to proceeding with work of this section.

1.12 WARRANTY

.1 Manufacturer's Warranty: Transferable, Total System/Labour, Material & Workmanship Warranty, No Dollar Limit, Non-Pro-Rated for a period of twenty (20) years from date of Substantial Performance for the project including; but not limited to, the following components:

.1 Roofing membrane

.2 Base flashings

.3 Roofing membrane accessories

.4 Roof insulation

.5 Other components of membrane roofing system

.2 Submit for Owner's acceptance, manufacturer's warranty document indicated above, executed by an authorized company official.

.3 Ensure that the Contractor obtains an ARCA Warranty Certificate for the specified warranty period, on behalf of the Province, for the performance of the Contractor's obligations under the extended warranty starting at Interim Acceptance of the work.

1.13 THIRD PARTY ROOFING INSPECTION

.1 The Province will engage third party roofing inspection. The Inspector will provide numerous inspections and reports to the Province during the progress of the roofing work, in accordance with the ARCA Roofing Applications Standards, to help ensure the roofing work is provided as set out in this Contract. Upon notice from the Province, the Contractor shall expediently perform all steps and make changes as identified by the roofing inspector, at no cost to the Province. The involvement of the roofing inspector does not relieve the Contractor of the responsibility to supervise, inspect and provide the roofing work as set out in this Contract.

.2 The Construction schedule shall include roofing inspections. The Province will provide the number of roofing inspections and the frequency. The Owner, Consultant, roofing inspector(s), and Roofing System manufacturer, at reasonable times, shall have proper and safe access to the Work, including parts of the Work in preparation at locations other than the Place of the Work, for the purposes of observation, inspection and testing.

.3 Provide copies of the manufacturer's site reports to the Owner, Consultant, and roofing inspector, prior to Interim Acceptance of the Work.

2 Products

2.1 MATERIALS - GENERAL

.1 Source Limitations:

.1 Products of specified roofing system shall be products of one manufacturer, or approved by roofing system manufacturer as part of a system as compatible with their system and listed in and covered by the Manufacturer's Warranty.

.2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

2.2 MANUFACTURERS - MEMBRANE MATERIALS

.1 Basis of Design: Soprema Inc.,

.2 Acceptable Manufacturer's: Equivalent systems from the following manufacturers will be considered provided they comply with performance requirements of this Section and the products specified:

.1 Firestone Building Products Canada.

.2 IKO Industries Ltd.

.3 Tremco Commercial Sealants & Waterproofing.

.4 Siplast.

.3 Substitutions: Not permitted.

2.3 MEMBRANE MATERIALS

.1 Roof Membrane: CAN/CGSB-37-GP-56M, ASTM D 6162 and ASTM D 6164 asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) prefabricated sheet.

.1 Prefabricated Roof Base Sheet: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, with heavy duty composite glass and polyester reinforcement; smooth surfaced with the following characteristics:

.1 Conforming to: CGSB 37-GP-56M Type 2, Class C, Grade 1.

.2 Thickness: 2.2 mm.

.3 Application: Fully adhered.

.4 Top surface suitable for torch-on application of cap sheet.

.5 Underside for hot mop asphalt application.

.6 Product: 'Elastophene 180 PS' manufactured by Soprema.

.2 Prefabricated Base Sheet Flashing: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, reinforced with woven fibre glass 180 g/m2; smooth surfaced with the following characteristics:

.1 Conforming to: CGSB 37-GP-56M Type 2, Class C, Grade 2.

.2 Thickness: 3.0 mm.

.3 Application: Fully adhered.

.4 Top surface suitable for torching cap sheet.

.5 Underside self-adhesive with silicone release sheet.

.6 Product: 'Sopraflash Flam Stick' manufactured by Soprema.

.3 Cap Sheet Membrane and Flashing Type 1: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, heavy duty composite glass and polyester reinforcement; upper surface finished with a factory applied white finish providing an SRI +/- 85 with the following characteristics:

.1 Conforming to: CGSB 37-GP-56M Type 1, Class A, Grade 2.

.2 Thickness: 3.5 mm.

.3 Application: Fully adhered.

.4 Top surface factory applied highly reflective white film granules.

.5 Underside suitable for torch-on.

.6 Product: 'Soprastar FLAM HD GR' manufactured by Soprema.

2.4 BITUMEN MATERIALS

.1 Asphalt Primer: ‘Elastocol Stick’ by Soprema for self-adhered applications; ‘Elastocol 500’ by Soprema for heat welded applications.

.2 SEBS Asphalt: ASTM D6152; A blend of SEBS and select asphalt for adhering membranes and overlay board.

.3 Asphalt Bitumen: CSA A123.4M Roof Asphalt Type 3.

.4 Plastic Cement: ASTM D2822 Type I or II, cutback asphalt type as recommended by roofing system manufacturer for application.

2.5 VAPOUR RETARDER

.1 Prefabricated Vapour Retarder Membrane (noted as membrane in roof system): Self-adhesive air/vapour barrier membranes composed of bitumen modified with thermoplastic polymers and high-density polyethylene film with the following characteristics:

.1 Water Vapour Permeance: +/- 1.7 ng/Pa.s.m2 (0.03 perm)

.2 Thickness: 0.8 mm.

.3 Product: ‘Sopravap'r' by Soprema, or an approved equivalent product by an acceptable manufacturer of this Section and compatible with the acceptable manufacturer’s system.

.2 Prefabricated Vapour Retarder Transition Strip and Flashing Self Adhesive: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS) type, polyester and glass reinforcement; smooth surfaced, as approved by system’s manufacturer.

2.6 INSULATION

.1 Provide roof insulation with minimum total of R-value **35**.

.2 Total aggregate thermal resistance of roof system to be minimum effective as indicated.

.3 Bottom Insulation; Faced Polyisocyanurate insulation boards, CAN/ULC-S704, Type 3, Class 3, HCFC and CFC-free, rigid board, inorganic coated-glass facers, and square edges.

.1 Board Density: 32 kg/cu m.

.2 Thermal Resistance: Min LTTR value of RSI value of 1.8 per 50 mm.

.3 Board Size: 1220 x 1220 mm and 1220 x 2440 mm

.4 Thickness: 125 mm.

.5 Acceptable Manufacturers- Polyisocyanurate Insulation:

.1 Atlas Roofing Corporation; Product: 'AC Foam III.'

.2 Firestone Building Products Canada; Product: 'RESISTA ISO.'

.3 IKO Industries Ltd; Product: 'IKOTherm III'

.4 Soprema Inc.; Product: 'SOPRA-ISO PLUS'

.6 Tapered Insulation:

.1 Board Thickness: As required for fabrication of slopes with a minimum thickness of 13 mm.

.2 Fabricate to minimum slope to drain meeting performance criteria specified. Provide custom saddles, sumps, crickets, tapered edge strips and other insulation shapes with increased local slopes to prevent trapping of water behind parapets returns or curbs.

.3 Design a custom configured sloping insulation to provide minimum slope to drains with custom sloped accessories.

.4 Single layer insulating system combining base insulation and tapered insulation will not be accepted as substitute to multi layer insulating system.

2.7 GYPSUM ROOF SHEATHING AND OVERLAY BOARD

.1 Gypsum roof sheathing and overlay board; ASTM C1396; 13 mm thick unless otherwise indicated; primed finish with non-woven glass mats embedded in a water resistant treated gypsum core; minimum compression strength 500 psi.

.1 Product:

.1 'DensDeck Prime Roof Board' manufactured by Georgia-Pacific Gypsum LLC,

.2 'Securock Gypsum Fiber Roof Board' by CGC Inc.

.3 'CertainTeed Glasroc Roof Board' by CertainTeed

2.8 ADHESIVES

.1 Insulation Adhesive: One or two component, low-rise, chemically cured urethane foam adhesive for the attachment of selected rigid roof insulation to one another and to adhere to vapour barrier membranes; contains no solvents and is compatible with the roofing Manufacturers system.

.1 Product: 'Duotack' by Soprema, or approved equivalent by an acceptable manufacturer of this Section and compatible with the acceptable manufacturer's system.

2.9 CARPENTRY

.1 Wood roof materials shall be as specified in Section 06 10 00 – Rough Carpentry. Do not use pressure treated materials where SBS membrane materials are to be adhered to wood fabrications.

2.10 ACCESSORIES

.1 Sheathing Joint Tape: Paper, heat-resistant type.

.2 Insulation Joint Tape: Asphalt treated glass fibre reinforced; 150 mm wide; self adhering.

.3 Flame-Stop Tape: Self-adhesive membrane composed of SBS modified bitumen and a glass mat reinforcement, designed to prevent flames from penetrating into voids, cavities and

openings before installing heat-welded membranes; type recommended by membrane Manufacturer.

.4 Roofing Nails: Galvanized, hot dipped type, size as required to suit application.

.5 Jointing Material for Overlay Board: Tape or sealant as recommended by membrane manufacturer.

.6 Sealants: As recommended by membrane manufacturer.

.7 Cant Strips: Fabricated from High density mineral wool, asphalt impregnated facer for torch application; 100 mm x 100 mm fabricated to 45 degree angle (with min.140 mm sloped face) dimension.

.1 Basis of design: 'CantRSS' by modular RTS or equivalent by listed manufacturer

.2 Cant Strip-Insulation Adhesive: Recommended by membrane manufacturer.

.8 Termination Bars: Aluminum, surface mounted, prepunched, maximum possible length per location, with attachment flanges.

.9 Walkway: SBS modified membrane reinforced and nonwoven polyester fabric granular surfaced, suitable for torch-on application, free of selvedge.

.1 Size: Minimum 5.0 mm thick.

.2 Granule Colour: Different from cap sheet and as selected by Consultant.

.3 Product: 'Soprawalk' by Soprema or approved equivalent

.10 Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer.

.11 Miscellaneous Accessories: Provide all miscellaneous accessories recommended by roofing system manufacturer.

.12 Roof Supports:

.1 Aluminum (Single, Insulated) Pipe Supports: Hollow aluminum pipes with mill finish, urethane insulated supports, 51 mm dia., with appropriate hardware , for fastening to structural roof deck, and Type 304 stainless steel pipe cradle assembly sized to suit actual pipe O.D. Provide insulated Stack Jack Flashings for each pipe support.

.1 Product: 'MERS-610A Pipe Support' by Thaler Metal Industries Ltd., or approved equivalent by Altra Metal Specialties Inc.

.2 Aluminum (Double, Insulated) Pipe Supports: Hollow aluminum pipes with mill finish, urethane insulated supports, 51 mm dia., with appropriate hardware , for fastening to structural roof deck, and Type 304 stainless steel pipe cradle assembly sized to suit actual pipe O.D. Provide insulated Stack Jack Flashings for each pipe support.

.1 Product: 'MERS-615A Pipe Support' by Thaler Metal Industries Ltd., or approved equivalent by Altra Metal Specialties Inc.

.3 Miscellaneous Roof Supports: CSA-G164 – epoxy coated urethane insulated, hollow steel support with fastening, threaded steel cap with 305 mm square steel adapter stub and 16 mm stainless steel retaining bolt;

.1 Product: 'ARS-550-2' by Thaler Metal Industries Ltd., or approved equivalent by Altra Metal Specialties Inc.

.13 Roof drain: Refer to Mechanical Drawings.

.14 Pavers:

.1 610 x 610mm size, 45 mm thick, precast concrete paver units; diamond pattern; colour: Natural. Approved manufacture:

.1 Brooklin Diamond Texture by Armtec.

.2 Roof Ballast Paver by Hanover Architectural Products.

.3 Approved equivalent.

.2 Paver support pad: Closed cell extruded expanded polystyrene board, with square edges. 25 mm thick. Width to match pavers width specified. Approved Product:

.1 Styrofoam brand “Highload 40” by Dow.

3 Execution

3.1 GENERAL

.1 Perform roofing installation in accordance with membrane manufacturer’s written instructions and to CRCA and local provincial roofing contractors association of the project Roofing Specifications Manual requirements.

.2 Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

.1 At end of each day's work, provide water cut-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed. Minimize or eliminate staggered joints to accommodate water cut-offs.

.2 Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system. Use membrane flashings consistent with permanent detailing sealed to base layer and vapour retarder with minimum 100 mm laps.

.3 Remove and discard temporary seals before beginning work on adjoining roofing.

.3 Provide water cut-offs to prevent dispersion of moisture at insulation level throughout roof assembly, in the event of future roof leak. Locate cut-offs at 9 m intervals each way.

.4 Install cap sheets within 48 hrs of installation of base sheets.

.5 No visible fasteners permitted on underside of exposed decks.

3.2 EXAMINATION

.1 Verify that surfaces and site conditions are ready to receive work.

.2 Verify deck is supported and secured.

.3 Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

.4 Verify deck surfaces are dry and free of snow or ice.

.5 Confirm dry deck by moisture meter with 12 percent moisture maximum.

.6 Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and correctly located.

3.3 PREPARATION – GENERAL

.1 Prepare surfaces in accordance with Standards and manufacturer's written installation instructions of CRCA and local provincial roofing contractors association of the project.

3.4 GYPSUM ROOF SHEATHING

.1 Apply with adhesive in conformance with manufacturer's written recommendations to obtain wind uplift rating specified.

3.5 VAPOUR RETARDER APPLICATION

.1 Primer: Apply primer in accordance with manufacturer's written instructions for system specified. Allow to dry.

.2 Apply vapour retarder to substrate surface with adhesive overlapping side and end laps in conformance with manufacturer's written recommendations.

.3 Stagger laps a minimum of 300 mm.

.4 Begin work at bottom of slopes; unroll and align on substrate, ensuring full contact and support at edges.

.5 Meet and overlap air/vapour barrier on adjoining walls.

.6 Seal membrane at insulation perimeters and around penetrations to ensure sealed connections with base sheet at upstands.

3.6 INSULATION APPLICATION

.1 Install insulation to manufacturer written instructions.

.2 Ensure vapour retarder is clean and dry.

.3 Bottom Insulation: Install bottom layer of insulation in minimum 2 layers. Apply adhesive to substrate in accordance with adhesive and insulation manufacturer's written instructions. Embed first layer of insulation into adhesive over vapour retarder in accordance with manufacturer's recommendations.

.1 For second layer of bottom insulation, apply adhesive to the top surface of first layer of insulation. Embed the second layer of insulation into adhesive, with joints staggered minimum 300 mm from joints of first layer.

.4 Tapered Insulation: Place constant thickness first layer and tapered thickness insulation second layer to indicated slope pattern in accordance with manufacturer's written instructions.

.1 Embed insulation into adhesive as per manufacturer's instructions.

.5 Minimum Total Insulation Thickness: As required to achieve insulation R or RSI value as indicated. Do not use tapered insulation in the calculation of thickness required.

.6 Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

.7 Lay tapered boards for a distance of 450 mm back from roof drains for positive drainage.

.8 Apply no more insulation than can be covered with membrane in same day.

3.7 OVERLAY BOARDS

.1 Install overlay boards with adhesive in accordance with manufacture recommendations over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 150 mm in each direction from joints of insulation below. Loosely butt cover boards together. Tape or seal joints if required by roofing system manufacturer.

.2 Immediately cover overlay boards with subsequent materials; do not leave exposed.

3.8 MEMBRANE APPLICATION

.1 Apply membrane and primer to manufacturer written instructions.

.2 Hot mop –fully adhere base sheet with SBS modified asphalt at a rate of 1.25 kg/m2.

.3 Apply membrane; lap and seal edges and ends permanently waterproof.

.4 Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate. Use rollers

.5 Extend membrane minimum of 200 mm onto vertical surfaces. Secure base sheets to vertical surfaces of parapets with binder bars.

.6 Extend membrane over vapour and air barrier of wall construction and seal.

.7 Mop and seal membrane around roof protrusions and penetrations.

.8 Torch cap sheet to manufacturer written instructions. On exposed membranes lap cap sheets at seams to limit bitumen bleed-out. Alternatively, apply loose granules of same colour as cap sheet to bitumen bleed-out while material is hot; ensure full coverage and embedment. Visible bleed-out not permitted.

3.9 FLASHINGS AND ACCESSORIES

.1 Apply flexible sheet base flashings to seal membrane to vertical elements.

.2 Secure to nailing strips at 100 mm on centre.

.3 Fabricate roofing control and expansion joints to isolate roof into areas as indicated.

.4 Install prefabricated roof penetration flashings and expansion joint flashings in accordance with manufacturer's instructions.

.5 Coordinate installation of roof drains, curbs, and related flashings.

.6 Seal flashings and flanges of items penetrating or protruding through the membrane.

.7 At locations where standard flashing materials cannot be used apply liquid membrane flashing in accordance with manufacturer’s details.

3.10 SITE QUALITY CONTROL

.1 Owner will hire an independent inspection agency for this project to provide inspection services and verify conformance of roofing to specified requirements. Owner to appoint and pay for roof inspections.

.2 Notify Inspection Company, roofing membrane manufacturer and Consultant 72 hours in advance of commencing roofing. Inspection Company will:

.1 Carry out full and complete inspections while the work is in progress, at completion of roofing installation and just prior to the date of Substantial Performance

.2 Inspect and review materials and workmanship including storage, handling and protection. Advise the Consultant and the Owner of inspections.

.3 Include procedures followed; ambient temperatures, humidity, wind velocity during application.

.4 Submit a daily report while work is in progress to the Owner, Consultant, Roofing subcontractor and Contractor. This report is to be countersigned by the Roofing Subcontractor’s Superintendent acknowledging content.

.3 Inspection of all roofing to be provided by Owner appointed inspection agency.

3.11 MANUFACTURERS SITE SERVICES

.1 Attend Pre-installation Meetings:

.1 Review preparation and installation procedures and coordinating and scheduling required with related work.

.2 Require site attendance of roofing system manufacturer's technical personnel during installation of the Work to provide field surveillance of the installation of their Products:

.1 Schedule of Site Visits: Provide a minimum of three visits beginning with initial start-up of installation, at 25% completion and at 50% completion for each roof assembly.

.2 Inspect and review materials and workmanship including storage, handling and protection. Advise Consultant and Owner 48 hours in advance of inspections.

.3 Monitor and report installation procedures and unacceptable conditions.

.4 Manufacturer's representative to provide a written Site Report for each Site visit.

.3 Correct identified defects or irregularities.

.4 Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion of roofing membrane and flashing.

.1 Notify Consultant and Owner 48 hours in advance of date and time of final inspection.

.2 Manufacturer's representative to provide a written Site Report for Final Inspection.

3.12 CLEANING

.1 In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

.2 Repair or replace defaced or disfigured finishes caused by work of this section.

3.13 PROTECTION OF FINISHED WORK

.1 Protect building surfaces against damage from roofing work.

.2 Where traffic must continue over finished roof membrane, protect surfaces using 19 mm thick plywood sheets of plywood arranged and installed to prevent tripping and wind uplift.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of;

.1 Cap and base flashing; curb flashings,

.2 Roof edge flashing,

.3 Flashing at intersection of roof with vertical surfaces,

.4 Break metal flashings where shown,

.5 Prefinished flashings where indicated,

.6 Any other flashing as indicated on the drawings or as required, including all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

.2 Furnish, complete, all materials which shall be installed by other trades as specified and/or shown on the drawings including:

.1 Furnish to Section 04 20 00 all metal flashings and counter flashings which are to be built into masonry work.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

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

.2 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

.3 Canadian Roofing Contractors Association

.1 CRCA Specifications Manual

1.4 SUBMITTALS

.1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with the Contract Requirements, Contract General Requirements .

.2 Submit shop drawings indicating material, thickness and finish.

.3 Submit duplicate 100mm x 100mm (4” x 4”) samples of each type of sheet metal material, colour and finish for review by Consultant prior to fabrication.

1.5 QUALITY ASSURANCE

.1 Fabricator and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of Work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of metal flashing systems shall be by workmen especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Store materials flat at site under protection to prevent staining from the work of other trades or from collection of water on material and secured against wind damage.

.2 Carefully store preformed sheet metal work in such a manner as to prevent twisting, bending and rubbing.

.3 Protect sheet metal work from corrosive materials and dissimilar metals.

1.7 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of two (2) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.

.2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.

.3 Promptly make good defects and/or failures in the work of this Section upon written notification by the Owner that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and Owner's property damaged or disturbed in the course of remedying defects.

2 Products

2.1 MATERIALS

.1 Aluminium Plates and Sheets: ASTM B209, alloy 3105-H14 or 3003-H14, factory finished after fabrication.

.2 Aluminium Plates: Commercial quality 3.2 mm (0.125”) nominal thickness.

.3 Aluminium Sheet: Minimum 1.15 mm (0.453”) thick.

.4 Nails, bolts screws and rivets: Material - galvanized steel, stainless steel or same metal as material to be fastened. Type - to approved samples.

.5 Isolation coating: Alkali and acid resistant bituminous paint.

.6 Field Touch-Up Paint: As recommended by factory finish material manufacturer.

.7 Underlay for metal flashing: Asphalt laminated 3.6 to 4.5 kg kraft paper.

.8 Sealant: Multi-component, chemical curing epoxidized polyurethane type sealant conforming to ASTM C920 Dymeric 240FC by Tremco (Canada) Ltd., or approved equal. Colour as selected later by Consultant. Provide primers, bond breakers and cleaning agents as recommended by the sealant manufacturer.

.9 All other materials not specifically described but required for a complete and proper installation of the work of this Section shall be new first quality of their respective kinds and subject to the approval of the Consultant.

2.2 FABRICATION

.1 Fabricate metal flashings and other sheet metal work to applicable CRCA 'FL' series specifications and as detailed.

.2 Form flashings, counter flashings, scuppers and copings as required to suit each condition. Use prefinished sheet steel in all locations. Form pieces in 2438 mm (8'-0") maximum lengths. Make allowance for expansion at joints.

.3 Fabricate sheet metal components with lines, arises and angles sharp and true and plane surfaces free from objectionable wave, warp or buckle.

.4 Mitre and seal corners with sealant. Form drip edging at 45 deg angle, secure with a continuous 20 ga. hold-down clip.

.5 Exposed edges of sheet metal shall be folded back to form a 13 mm (1/2") wide hem on the side concealed from view. Prefabricate corner pieces for flashings and copings. The workmanship and methods employed for forming, anchoring, cleating and the provision for expansion and contraction of sheet metal work shall be to the approval of the Consultant.

.6 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.7 Fabricate scuppers and overflow scuppers to applicable CRCA 'FL' Series details and as detailed.

.8 Apply two coats of bituminous paint to metal surfaces to be in contact with masonry, concrete, mortar or dissimilar metals.

2.3 FINISHING

.1 Factory Finish Aluminium Plates and Sheets.

.1 High Performance Multiple Coat Fluoropolymer: AA-C12C40R1x, chemical finish: cleaned with inhibited chemicals; chemical finish: conversion coating; organic coating. Thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color coats, and topcoat containing not less than 70% polyvinylidene fluoride resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions, custom metallic colour.

3 Execution

3.1 EXAMINATION

.1 Inspect substrate surfaces on which the work of this Section is erected for any irregularities detrimental to the application and performance of the Work. Confirm conditions satisfactory before proceeding. Report to Consultant in writing, defects of work prepared by other trades and unsatisfactory site conditions. Commencement of work implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Metal flashing shall be in compliance with best sheet metal trade practice and shall in no way be contrary to sheet metal practice that will qualify for the Guarantee Certificate specified. Install with "S" lock expansion joints or standing seams incorporated on end of flashing length and all joints sealed with mastic.

.2 Provide continuous starter strips to present true, non-waving leading edge. Provide clips and anchor to backup in an approved manner to provide rigid, secure installation. Conceal fastenings in completed flashing. Lap, lock and seal all seams.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100mm (4").

.4 Install sheet metal flashings, cap flashings and copings as indicated on drawings using flat lock seams. Make joints to permit thermal movement. Make surfaces free from buckling, warp, wave, dents, oil canning or other defects. Make corners square and surfaces straight and in true planes. Equally space joints in cap flashings to suit wall panel module. Space seams not farther apart than 2439mm (8').

.5 All sheet and strip flashing to be held in place by 14 gauge galvanized iron clips of a size and type to be determined by the construction requirements, except where specifically detailed on the drawings.

.6 Caulk flashing at cap flashing with sealant.

.7 Lock end joints and caulk with sealant.

.8 Use rubber-asphalt sealing compound for joints between sheet metal and bitumen.

.9 Supply rigid flashing, copings and sheet metal back-up to other trades where required to be built into other work at doors, windows, block openings, curbs and where shown on drawings.

.10 Take careful note of fans, vents, etc., on mechanical drawings to determine whether flashing and counter flashing is required or whether units are self-counter flashing.

.11 Caulking shall be installed as per written manufacturer's recommendations.

.12 Exposed fastenings will be permitted where indicated or where concealed fastening is not possible. Obtain Consultant's approval of exposed fastenings and methods of making same.

.13 If exposed screws or bolts are used, use cupped neoprene washers.

.14 Install scupper drains and overflow scupper drains as indicated on drawings, in strict accordance with CRCA manual.

3.3 CLEANING

.1 Remove, as the work progresses, all excess or foreign material which would set up or become difficult to remove from finished surfaces.

.2 Do all final cleaning upon completion of the Work of this Section. Leave building and Work in condition to meet the approval of the Consultant.

.3 Remove excess sealant by the moderate use of mineral spirits or other solvent acceptable by the sealant manufacturer.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of:

.1 Preformed Penetration Flashings.

.2 Roof Supports.

.3 Freestanding Roof Equipment Screen.

.2 Accessories and flashing material as required and as indicated on the drawings, including all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

1.3 PERFORMANCE REQUIREMENTS

.1 Equipment Screen:

.1 Design louvers, including comprehensive engineering analysis by a qualified engineer, using structural performance requirements and design criteria indicated.

.2 Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

.1 Wind Loads: Determine loads based on a uniform pressure of 1435 Pa (30 lb./sq. ft.), acting inward or outward.

.2 Deflection Criteria: Framing member deflection shall not exceed L/120

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Bearing professional seal and signature of a professional engineer responsible for the engineering design of work of this Section. Show dimensions, plans, elevations, details, including accessory profile, layout, materials, construction, and securement method to building structure. Indicate performance requirements to design criteria.

.2 Furnish complete shop and erection drawings required for the work of this section to the Consultant for review prior to fabrication. Shop drawings shall bear the seal and signature of a Professional Engineer registered to practice at the Place of Work.

.3 Co-ordinate shop drawings for work of this section with those for other trades to ensure correct interface details required to provide watertight installation.

.4 Shop drawings shall incorporate plans, elevations, sections and details for all work in this Section. The details shall show and specify all metal thicknesses, types and finishes; areas to be sealed and sealant materials; type of construction including joinery, fasteners and welds; all anchorage assemblies and components; connections, fastenings, shapes and finishes; the fabrication and erection tolerances for the work in this section and the adjoining related work of other sections.

.2 Product Data: Submit product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

.3 Maintenance Manuals: Include complete written and illustrated instruction manuals relative to the care, adjustment and operation of all parts of the equipment, a complete description and listing of components, with recommended frequency of service and maintenance to ensure maximum efficiency, reliability and long life of the equipment.

1.5 QUALITY ASSURANCE

.1 Fabricator and tradesmen executing the work of this Section shall have had a minimum five (5) years continuous Canadian experience in successful manufacture and installation of Work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of roofing specialties shall be by workmen especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.

.3 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper maintenance procedures.

.4 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.5 Manufacturer’s Site Inspection: Have the manufacturer’s technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. Submit manufacturer’s inspection reports and verification that the work of this Section is correctly installed.

.6 Source Limitations: Obtain each type of product from a single manufacturer.

1.6 DELIVERY/STORAGE/HANDLING

.1 Inspect material upon delivery and order replacements for any missing or defective items. Keep material dry, covered and off the ground until installed.

1.7 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with General Conditions, but for a period of two (2) years. Agree to promptly make good defects which become evident during warranty period without cost to the Owner.

.2 Without restricting the generality of the Warranty, defects shall include deformation, buckling, leakage, weather tightness, failure of anchors and fastenings, failure of paint coating and sealants.

.3 Promptly make good defects and/or failures in the work of this Section upon written notification by the Owner that such exist. Remedy shall include labour, materials, equipment and services required to make good defective work, and to replace components and finishes and Owner's property damaged or disturbed in the course of remedying defects.

2 Products

2.1 MANUFACTURERS

.1 Specified Products: Work of this Section are based on specified products. Products by other manufacturers similar in function, design, performance, and construction complying with

requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

2.2 PREFORMED PENETRATION FLASHINGS

.1 Split Flashing: 0.46 mm (0.018") thick type 304 stainless steel with matching cap, properly sized, EPDM grommet capped seals, continuous EPDM split junction and deck flange seals, coated deck flange compatible with roofing system.

.1 Round Flashing, Non-Vented Cap: SPJ-1 by Thaler.

.2 Round Flashing, Vented Cap: SPJ-2 by Thaler.

.3 Square Flashing, Non-Vented Cap: SPJ-3 by Thaler.

.4 Square Flashing, Vented Cap: SPJ-4 by Thaler.

.2 Single Flexible Conduit Flashing: Liquid tight, 2.7 mm (0.109") thick mill finished 6061-T4 aluminium, EPDM end and cap seals, properly sized holes to suit conduits, coated deck flange compatible with roofing system, MEF-2A Series by Thaler.

.3 Single Rigid Conduit Flashing: [1.6 mm (0.064") mill finished aluminium] [0.46 mm (0.018") type 304 stainless steel], insulated, EPDM end and cap seals, properly sized holes to suit conduits, coated deck flange compatible with roofing system, MEF-SSE1 Series by Thaler.

.4 Double Flexible Conduit Flashing: 1.6 mm (0.064") thick mill finished 1100 aluminium, insulated, moulded-in-place EPDM grommet seals, properly sized holes to suit conduits, galvanized conduit fittings, aluminium base enclosure, coated deck flange compatible with roofing system, MEF-AE2 by Thaler.

.5 Multiple Flexible Conduit Flashing: Flexible flashing, 1.6 mm (0.064") thick mill finished 1100 aluminium, insulated, moulded-in-place EPDM grommet seals, properly sized holes to suit conduits, galvanized conduit fittings, aluminium base enclosure, coated deck flange compatible with roofing system, MEF-AE4 by Thaler.

.6 Exhaust Vent Flashing: 1.6 mm (0.064") thick mill finished 1100 aluminium, two piece collar, EPDM grommet cap seals, properly sized holes to suit vent, coated deck flange compatible with roofing system, MEF-4A Series by Thaler.

.7 Hot Pipe Flashing: 1.6 mm (0.064") thick mill finished 1100 aluminium, two piece collar, properly sized to suit hot pipe, coated deck flange compatible with roofing system, MEF-3A Series by Thaler.

.8 Stack Vent Flashing: Vandal resistant, 1.6 mm (0.064") thick mill finished 1100 aluminium body, hood and perforated collar, premoulded polyurethane insulation liner, EPDM grommet cap seals, properly sized holes to suit vent, coated deck flange compatible with roofing system, SPJ-31 Series by Thaler.

.9 Sloped Roof Stack Vent Flashing: Properly sized, 305 mm high, [1.6 mm (0.064") mill finish 1100 0T alloy aluminum] [0.831 mm (0.032") (24 oz.) copper] [0.8 mm (0.031", 22 ga.) type 304 stainless steel] round flashing, EPDM Triple Pressure Grommet Seal and EPDM Base Seal, coated deck flange compatible with roofing system, SJ 45 by Thaler.

2.3 ROOF SUPPORTS

.1 Access Ladder Supports: Epoxy coated, hot dipped galvanized hollow steel support complete with appropriate hardware for fastening to structural roof deck; epoxy coated threaded steel cap with ladder lugs suitable for receiving a minimum 13 mm (1/2") thick steel ladder side rails; 10 mm (3/8") stainless steel retaining bolts; and urethane insulated [1.6 mm (0.060") mill finish 1100-0T alloy aluminium] [0.83 mm (0.032") copper] [0.8 mm (0.031") Type 304 stainless steel] flashing with EPDM Base Seal and coated deck flange compatible with roofing system, ARS-500 by Thaler.

.2 Metal Stair Supports: Epoxy coated, insulated hot dipped galvanized hollow steel support complete with appropriate hardware for fastening to structural roof deck; 100 mm (4") stainless steel cap; stainless steel stringer adapter angle bracket; stainless steel retaining bolts and fasteners; and urethane insulated 0.8 mm (0.031") Type 304 stainless steel flashing with EPDM Base Seal and coated deck flange compatible with roofing system, height as indicated, ARS-510-2 NS by Thaler.

.3 Guardrail Assemblies: Preformed roof flashing and 1067 mm (42") high aluminum railing with vertical posts at [1200 mm (48")] [1800 mm (72")] [2400 mm (96")] spacing, ARS-102A by Thaler. Engineer and design guardrail assemblies to requirements of the governing building code and authorities having jurisdiction for vertical and horizontal loads.

.4 Railings: Mill finish insulated 38 mm (1-1/2") schedule 40 aluminium vertical posts, top and bottom rails, welded 200 mm x 200 x 10 mm (8" x 8" x 3/8") aluminium base plates and cast aluminium top rail/vertical post connectors complete with stainless steel set screws.

.5 Preformed Roof Flashings: 175 mm (7") high, [1.6 mm (0.064") mill finish 1100 0T alloy aluminum] [0.831 mm (0.032" mm, 24 oz.) copper] [0.8 mm (0.031", 22 ga.) type 304 stainless steel] round flashing, insulated, EPDM Triple Pressure Grommet Seal and EPDM Base Seal, coated deck flange compatible with roofing system, New-Standard SJ 37 by Thaler.

.6 Security Lighting/Camera Supports: Epoxy coated, insulated hot dipped galvanized hollow steel support complete with appropriate hardware for fastening to structural roof deck; epoxy coated threaded steel cap with ladder lugs suitable for receiving a minimum 50 mm (2") diameter conduit head; weather resistant 19 mm (3/4") stainless steel retaining bolts with EPDM seals to prevent counter-rotation of cap and conduit head; urethane insulated [1.6 mm (0.060") mill finish 1100-0T alloy aluminium] [0.831 mm (0.32", 24 oz.) copper] [0.8 mm (0.32") type 304stainless steel] flashing with EPDM Base Seal and coated deck flange compatible with roofing system, MERS-730 by Thaler.

2.4 FREE STANDING ROOF EQUIPMENT SCREEN

.1 Material:

.1 Aluminum Extrusions: ASTM B 221M, Alloy 6063-T5.

.2 Aluminum Sheet: ASTM B 209M, Alloy 3003 with temper as required for forming.

.3 Fasteners: Use types and sizes to suit unit installation conditions.

.1 For fastening aluminum, use aluminum or 300 series stainless-steel fasteners

.2 Provide equipment screen to size as indicated in the drawings.

.3 Aluminum Base Supports and Structural Framing: Mill finish to material thickness of below:

.1 Base Support: Minimum 2.03 mm (0.08").

.2 Frame Member: Minimum 3.2 mm (1/8").

.3 Curb Cap: Minimum 3.2 mm (1/8").

.4 Connection Bracket: Minimum 6.4 mm (1/4").

.5 Component Design Requirements:

.1 Posts and Girts: 75 mm x 75 mm (3" x 3") profiles with slots for easy attachment to other components

.2 Kicker Braces and Racking Braces: 38 mm x 38 mm (1-1/2" x 1-1/2") profiles with slots for easy attachment to other components.

.3 Connection Brackets: Minimum 4 holes per leg for acceptance of 8 mm (5/16") fasteners.

.6 Basis of Design Product: Sturdistruct Framing by Architectural Louvers Co.

.4 Horizontal Blade Louvered: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat finish, to profile below:

.1 Blade Profile: 2.03 mm (0.08") thick, 150 mm (6") deep, plain blade without center baffle.

.1 Blade Spacing: 125 mm (5") centers.

.2 Louver Performance Requirements:

.1 Free Area: Not less than 1.05 m^2 (11.7 sq. ft.) for 1220 mm (48") wide by 1220 mm (48") high louver assembly.

.2 Horizontal Drag Coefficient: Not greater than 0.29 on a cross sectional profile, allowing for a 71% reduction in wind load imposed horizontally upon supporting structural framing

.3 Basis of Design Product: Model V6JN5 by Architectural Louvers Co. Colour to be selected by Consultant.

2.5 FABRICATION

.1 Fabricate, assemble and erect manufactured materials in accordance with manufacturer's published specifications for specific types of functions required; manufacturer's specifications are considered to form part of this Section.

.2 Fabricate assemblies complete in every respect, square, true to size and details, and free from distortion, twist or other defects that could affect strength, operation or appearance.

.3 Fabricate Roof Equipment Screen:

.1 Join concealed frame members to each other and to fixed louver blades with fillet welds concealed from view welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary

.2 Join support and framing members to each other and to connection brackets with threaded fasteners. Join equipment rail components with fillet welds.

3 Execution

3.1 EXAMINATION

.1 Report in writing defects in adjacent work and other unsatisfactory site conditions that could affect work of this Section.

.2 Verify site dimensions. Commencement of work will imply acceptance of prepared work.

.3 Inspect roof system is properly attached and installed to withstand additional retained loading.

3.2 INSTALLATION

.1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.

.2 Ensure water-tightness continuity of roofing systems.

.3 Adjust and seal assembly with provision for expansion and contraction of components.

.4 Coat metals contact with dissimilar materials, with isolation coating.

.5 Apply full coverage sealant to fastener penetrations at roof surface and underside of through fasten brackets.

3.3 INSTALLATION – ROOF EQUIPMENT SCREEN

.1 Install base supports, framings, and louver screens in accordance with manufacturer's printed instructions.

.2 Locate and place base supports and equipment screens level, plumb, and at indicated alignment with adjacent work.

.3 Posts and Girts shall be level and plumb to accept equipment screens being supported.

.4 Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.

.5 Provide perimeter reveals and openings of uniform width to allow for thermal expansion, as indicated.

.6 Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

3.4 ADJUSTING

.1 Verify that manufactured units are installed in accordance with specifications and details, and will function as intended.

.1 Adjust any items where necessary to ensure proper operation.

3.5 CLEANING

.1 Clean manufactured units using materials and methods approved by manufacturer.

.2 Do not use cleaners or techniques that could impair performance of the roofing system.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Section Includes

.1 Prefabricated steel roof hatch, with integral support curbs, safety railings, operable hardware, and counter flashings.

.2 Safety Bar.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings showing construction and anchorage of roof hatches and accessories including, details of all elements of assembly and construction.

.2 Related items shown on shop drawings which are not intended to be supplied as part of the work of this Section, shall be so identified. All dimensions shall be clearly noted and methods of fastening and anchoring detailed. Show accurately and identify all adjacent materials.

.2 Maintenance:

.1 On completion of work of this Section, supply maintenance instructions for insertion into Operating and Maintenance Manual.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Use a manufacturer that has completed roof hatch assemblies having similar extent and complexity as required for the Work of this Contract.

.2 Installers Qualifications: Use experienced installers having experience with roof hatch assemblies similar in material, design and extent as required for Work of this Contract with a record of successful in-service performance.

1.5 WARRANTY

.1 Warrant the work of this section in accordance with General Conditions but for a period of two (2) years and agree to repair or replace faulty materials or work which becomes evident during the warranty period without cost to the Owner and at the Owner's convenience.

2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products: Products named in this Section were used as the basis of design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Bilco Company

.2 Lexcor

.3 Acudor

2.2 ROOF HATCHES

.1 Manufactured Units:

.1 Size: 914 mm x 914 mm (36" by 36").

.2 Curb: 14 gauge galvanized G90 steel; 1 inch rigid insulation; integral cap flashing to receive roof flashing system; extended flange for mounting.

.3 Cover: 14 gauge galvanized G90 steel with one inch glass fibre insulation retained by 22 gauge steel inner liner. Continuous gasket to provide weatherproof seal.

.4 Hardware: Manufacturer's standard manually operated type with compression spring operators, positive snap latch with turn handles inside and out and padlock hasp inside; automatic hold-open arm with vinyl covered grip handle for easy release; cadmium plated finish.

.5 Hinges: Heavy duty pintle type.

.6 Fasteners: Corrosive resistant fasteners recommended by roof hatch manufacturer.

.7 Basis of Design Material: Type E-20 by Bilco Canada.

2.3 SAFETY POST

.1 Telescoping safety post complete with adjustable mounting hardware for securing to any ladder rung size. Unit to be complete with safety bar handle and stainless steel fasteners.

.2 Basis of Design Material: Ladderup Safety Post, Model LU-1 by Bilco Canada.

2.4 ROOF HATCH LADDER

.1 Steel Wall Ladder: As specified in Section 05 50 00 – Miscellaneous Metals.

2.5 SAFETY RAIL

.1 Posts and Rails: Round, reinforced fire retardant yellow fiberglass treated with a UV inhibitor, complete with Self-closing gate.

.2 Hardware:

.1 Mounting brackets shall be 6 mm (¼") thick hot dip galvanized steel.

.2 Hinges and post guides: 6063T5 aluminum.

.3 Fasteners: Type 316 stainless steel.

.3 Basis of Design Material: Bil-Guard Hatch Railing System, Model RL-S by Bilco Canada.

2.6 FABRICATION

.1 Fabricate free of visual distortions and defects. Weld corners and joints.

.2 Fabricate units weather tight with integral cap flashing, providing for removal of condensation.

.3 Prime paint; one coat.

.4 Spot weld hasp, latch and hinges to prevent removal from interior.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions. Co-ordinate with installation of roofing system and related flashings. Provide weather tight installation.

.2 Apply bituminous paint on metal surfaces of units in contact with cementitious materials and dissimilar metals.

.3 Safety Bar: Install in strict accordance with manufacturer's published instructions.

.4 Safety Rail: Attach hatch rail system to the cap flashing of the roof hatch, as recommended by safety rail manufacturer. No penetration of roofing material is required.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Systems comprising fireproof firestopping and smoke seal materials and accessories, at joints and penetrations in fire resistance rated wall, floor and roof assemblies, materials and components.

.2 Firestopping at joints at exterior curtain-wall/floor intersections.

.3 Rated foam seal joint system.

.4 Manufacturer's site services and site quality control.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 Underwriters Laboratories of Canada (ULC):

.1 CAN/ULC S115, Standard Method of Fire Tests and Firestop Systems

.2 ULC XHEZC GuideInfo – Firestop Systems

1.5 PERFORMANCE REQUIREMENTS

.1 Materials, accessories and application procedures listed by ULC, cUL, WHI (Intertek/Warnock Hershey) or OPL (Omega Point Laboratories), or tested in accordance with CAN/ULC-S115 to comply with building code requirements.

.2 Fire-Resistive Joint Systems:

.1 Generally, use listed assemblies types F, FT, FH or FTH, as applicable.

.2 Joints at Exterior Curtain-Wall/Floor Intersections: Use joint systems tested at a positive pressure differential of 2.49 per ASTM E2307.

.3 Firestopping Materials: CAN/ULC-S115 and ASTM E2307, and to achieve fire ratings indicated.

.4 Surface Burning of Exposed Materials: CAN/ULC-S102 with a minimum flame spread/smoke developed rating of 25/50.

.5 Engineering Judgment: Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, provide an Engineering Judgment acceptable to the authority having jurisdiction.

1.6 SUBMITTALS FOR REVIEW

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Provide data on product characteristics, performance and limitation criteria, and indicating construction details accurately illustrating Project conditions. Include descriptions sufficient for identification at Project site.

.3 System Design Listings: Submit system design listings including design designations, locations and illustrations, from a qualified testing and inspection agency applicable, to each firestop configuration.

.1 Where Project conditions require modification to a qualified testing agency's illustration for a particular firestopping system condition, submit illustration, with modifications marked, approved by firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire resistance rated assembly.

.4 Firestop System Engineering Judgments: When required for acceptance by the authority having jurisdiction, Firestop System Engineering Judgment submissions shall:

.1 Clearly indicate that the recommended firestop system is an engineering judgment;

.2 Identify the job name, project location and firm which the engineering judgment is issued to.

.3 Be prepared, stamped and signed by a professional engineer, specializing in fire protection and licensed to practice in the place of the work.

.4 Be presented in appropriately descriptive written form with or without detail drawings where appropriate;

.5 Reference tested system(s) which the engineering judgment is based on;

.6 Include clear directions for the installation of the recommended firestop system;

.7 Include dates of issue and authorization signature as well as the issuer’s name, address and telephone number;

.5 Samples:

.1 Submit samples of each type of firestop and smoke seal material and accessory.

1.7 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For manufacturer and installer.

.2 Installation Data: Manufacturer's special preparation and installation requirements.

.3 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

.4 Delegated Design Submittals: Design firestopping assemblies required by the Contract Documents to withstand fire ratings indicated and in accordance with the Building Code.

.1 Provide manufacturer’s standard listings where site conditions match standard assembly listing.

.2 Provide manufacturers engineered judgement with acceptance by authorities having jurisdiction, signed and sealed by the manufactures; fire protection engineer where assembly does not match standard assembly listing.

.5 Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:

.1 Materials have been tested for bond with substrates.

.2 Materials have been verified by manufacturer to be compatible with substrate.

.3 Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.8 QUALITY ASSURANCE

.1 Applicator shall be licensed by the manufacturer of fireproofing materials.

.1 Accredited Canadian members of the Firestop Contractors International Association (FCIA).

.1 Certified installer listed under the ULC's Qualified Firestop Contractor Program.

.2 Submit manufacturer's certification that materials meet or exceed specified requirements.

.3 Maintain flame and temperature ratings equal to surrounding materials.

.4 Single Responsibility: Perform work using single applicator having undivided responsibility for entire Project, including coordination with plumbing, mechanical and electrical installations.

.5 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Deliver materials in original, unopened packages bearing name of manufacturer and product identification.

.2 Store materials off ground, under cover, and away from damp surfaces.

1.10 SITE CONDITIONS

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.

2 Products

2.1 FIRESTOP MANUFACTURERS

.1 Subject to compliance with requirements provide products of one of the following manufacturers:

.1 3M Fire Protection Products.

.2 Hilti Canada Ltd.

.3 Specified Technologies Inc.

.4 Tremco Inc.

.5 Emseal Joint Systems Ltd.

2.2 FIRESTOP SYSTEMS

.1 Provide firestop systems to follow ULC XHEZC GuideInfo – Firestop Systems:

.1 Head of Wall Joint Firestop Systems: XHEZC.HW

.2 Joint Firestop Systems: XHEZC.JF

.3 Perimeter Joint Firestop Systems: XHEZC.PJ

.4 Service Penetration Firestop Systems: XHEZC.SP

.5 Service Penetration for Combustible Systems: XHEZC.SPC

2.3 FIRESTOP MATERIALS

.1 Cementitious Matrixes: Minimum 2758 kPa (400 psi) compressive strength when cured, to retard cable tray warping within the firestop seal.

.2 Elastomeric Assemblies: Flexible, elastomeric seal suitable to withstand the required movement and capable of returning to original configuration without damage to seal and without adhesive or cohesive failure.

.3 Primers: Manufacturer's standard for specific material, substrate, and end use.

.4 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.5 Damming and Backup Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.6 Pipe and Duct Insulation and Wrappings: Compatible with firestopping systems.

.7 Intumescent Pads: Permanently pliable type.

.8 Intumescent Composite Sheet: Composite sheet, strip or precut shapes.

.9 Sealants and Putty For Vertical and Overhead Joints: Non sagging.

.10 Sealants and Fluid Seals at Floors: Self levelling.

.11 Identification Labels: Minimum 75 mm x 100 mm (3" x 4") permanent self-adhering or mechanically retained corrosion resistant metal labels, with black text on yellow background.

.12 Indicate ULC or cUL firestopping system number, rating, products used, and contact information of installers.

2.4 RATED FOAM SEAL JOINT SYSTEM

.1 Foam Seal: Silicone pre-coated, preformed, pre-compressed, waterproof, self-expanding, size and fire rated requirement as indicated on drawings, movement +/- 50% accommodation to design. Sealant system shall be comprised of the following components:

.1 Apply foam seal with epoxy adhesive primer.

.2 Maintain continuous air/vapour and moisture barrier in conjunction with adjacent air/vapour barrier systems specified in Section [07 27 13 - Self-Adhered Air and Vapour Barrier Sheet Membrane] [07 27 26 - Fluid-Applied Membrane Air Barrier] [07 27 29 - Fluid-Applied Membrane Air Vapour Barriers] [07 27 39 - Vapour Permeable Air Barrier Membrane].

.3 Acceptable Product:

.1 EMSHIELD Series by Emseal.

.4 Colour:

.1 Non-exposed joints: Standard Grey.

.2 Exposed joints: Custom colour to match adjacent finishes.

2.5 ACCESSORIES

.1 Provide components for each firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components recommended by firestopping manufacturer in accordance with tested assembly being installed, and acceptable to authorities having jurisdiction.

.2 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

.3 Dam Material: Permanent:

.1 Mineral wool board: Minimum 64 kg/m³ density, non-combustible, flame spread of 0, smoke development of 0 to ULC S102.

.2 Mineral wool batt: Minimum 32 kg/m³ density, non-combustible, flame spread of 0, smoke development of 0 to ULC S102.

.3 Alumina silicate fire board.

.4 Sealants used in combination with other forming, damming and backing materials to prevent leakage of fill materials in liquid state.

.5 Fillers for sealants.

.4 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

.5 Water: Potable, clean and free from injurious amounts of deleterious substances.

2.6 FINISHES

.1 Colour: Red unless otherwise noted.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.

.3 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.

.2 Remove incompatible materials which may affect bond.

.3 Install backing and damming materials to arrest liquid material leakage.

.4 Mask adjacent surfaces to protect from spillage and over coating; immediately remove material from adjacent surfaces.

3.3 APPLICATION

.1 Apply primer and materials to manufacturer's written instructions, approved tested assemblies and details.

.1 Provide materials to maintain the fire separations in the project as indicated on the drawings.

.2 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

.3 Apply firestopping material in sufficient thickness to achieve rating and to uniform density and texture.

.4 Tool or trowel exposed surfaces to a uniform finish.

.5 Compress fibred material to achieve a density of 25-40 percent of its uncompressed density required for listed system.

.6 Place material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

.7 Place intumescent coating in sufficient coats to achieve rating required.

.8 Remove dam material after firestopping material has cured. Dam material to remain.

.9 Provide identification labels as specified.

.10 In non-fire rated construction indicated to prevent smoke movement, tightly pack voids of service penetrations and around openings with mineral wool insulation and sealant.

3.4 IDENTIFICATION

.1 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

.1 The words: "Warning: Through-Penetration Firestop System - Do Not Disturb"

.2 Contractor's name, address and telephone number.

.3 Designation of applicable testing and inspection agency.

.4 Date of installation.

.5 Manufacturer's name for firestop materials.

3.5 MANUFACTURER'S SITE SERVICES

.1 Require site attendance of firestopping product manufacturer during installation of the Work. Schedule manufacturer’s review of work procedures at stages listed:

.1 Pre-installation Meeting: 1 review at Site and meeting with authorized Installers.

.2 Installation: 3 reviews at Site: 1 at commencement of Work; 1 at 50% completion of Work; 1 upon completion of Work.

.2 Submit manufacturer’s written reports to Consultant describing:

.1 The scope of work requested.

.2 Date, time and location.

.3 Procedures performed.

.4 Observed or detected non-compliances or inconsistencies with manufacturers’ recommended instructions.

.5 Limitations or disclaimers regarding the procedures performed.

.6 Obtain reports within three days of review and submit immediately to Consultant.

.3 Monitor and report installation procedures and unacceptable conditions.

.1 Inspect and review materials and workmanship including storage, handling and protection. Advise Consultant and Owner 48 hours in advance of inspections.

.2 Correct identified defects or irregularities.

.4 Remove and replace unacceptable firestopping assemblies.

3.6 SITE QUALITY CONTROL

.1 Owner will engage an independent testing agency to perform the following special inspections and tests, and prepare reports in accordance with ASTM E2174 and ASTM E2393:

.1 Correct size of joint.

.2 Placement and anchorage of mechanical supports.

.3 Thickness of coatings.

.4 Correct use and location of backings and bond breaker materials.

.5 Adherence testing to verify material bond with substrate.

.2 Testing and inspecting of completed joints and seals shall take place in successive stages, and at a rate not less than one test per day for each Installer and material type. Where deficiencies

are found or firestopping is damaged or removed because of testing, repair or replace firestopping to conform to requirements.

.3 Do not proceed with installations for the next area until test results for previously completed installations show conformance to requirements.

.4 Products and materials will be considered defective if they do not pass tests and inspections.

.5 Proceed with enclosing firestopping with other construction only after inspection reports are issued and installations conform to requirements.

.6 Submit testing agency's written reports to Consultant.

3.7 CLEANING

.1 Clean installed work.

.2 Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Protect adjacent surfaces from damage by material installation.

3.9 SCHEDULE

.1 Firestop the following conditions and as indicated:

.1 Penetrations through fire resistance-rated construction.

.2 Tops of fire resistance rated walls.

.3 Intersections of fire resistance rated walls and non-fire rated walls.

.4 Control joints in fire resistant rated construction.

.5 Joints at exterior wall/floor intersections.

.6 Openings and sleeves installed for future use through fire resistant rated separations.

.7 Non-fire rated construction to prevent smoke movement. Pack void space at all service penetrations and other openings with either tightly packed mineral wool dam material, or sealant, or a combination of both. The sealant need not be rated.

.2 Rated foam seal joint in rated assemblies including:

.1 Rated foam seal joint at fire rated expansion joint location where fire resistance rating is required.

.2 Expansion joints in concrete masonry units.

.3 Service Penetrations shall include but not limited to:

.1 Mechanical Pipe Penetrations

.2 Mechanical Damper Joints: Top only in floor dampers

.3 Electrical Service Penetrations: Bus duct, etc.

.4 Electrical Outlet Boxes: Receptacles, switches etc., in fire-rated GWB only.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Sealants and joint backing.

.2 Acoustic sealants.

.3 Compressible seals.

.4 Site quality control and manufacturer's site services.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C509, Standard Specifications for Elastomeric Cellular Performed Gasket and Sealing Material

.2 ASTM C510, Standard Test Method for Staining and Color Change of Single-or Multicomponent Joint Sealants.

.3 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

.4 ASTM C1021, Standard Practice for Laboratories Engaged in Testing of Building Sealants.

.5 ASTM C1184, Standard Specification for Structural Silicone Sealants.

.6 ASTM C1193, Standard Guide for Use of Joint Sealants.

.7 ASTM C1248, Standard Test Method for Staining of Porous Substrate by Joint Sealants.

.8 ASTM C1330, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.9 ASTM D5893/D5893M, Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.5 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.

.2 Structural Sealant Joint Design: Provide calculations for structural bite, dead load support, glueline thickness, shear, and other parameters. Include confirmation that design data provided by Consultant have been reviewed and approved by sealant manufacturer.

.3 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.

.2 Submittals for Information:

.1 Qualifications Data: For Manufacturer and Installer.

.2 Installation Data: Manufacturer's special installation requirements.

.1 Indicate special procedures, surface preparation, perimeter conditions requiring special attention, and field quality control testing.

.3 Field reports.

.1 Site quality control report identifying procedures for site testing and verification.

.2 Manufacture site service report identifying materials have been installed in accordance with manufactures recommendations.

1.6 QUALITY ASSURANCE

.1 Applicator qualifications:

.1 Execute Work by applicators trained and approved by the manufacturer and having 5 years proven experience.

.2 Independent inspection and testing agency:

.1 Qualification: In accordance with ASTM C1021.

.2 Conduct field inspection and testing of sealant with the manufacturer’s representative for a minimum of [20%] [5%] of joints, including mixing of materials, joint preparation, priming, joint profile and thickness, application, adhesion, cohesion, and tooling.

.3 Prepare and submit inspection and test report results after each inspection. Include confirmation by the manufacturer that installation has been satisfactorily completed.

.3 Manufacturer’s representative:

.1 Review Site conditions, joint design, and installer’s qualifications. Report unsatisfactory conditions to Consultant.

.2 Check container labels, inspect preparation of substrate materials and review installation procedures 48 hours in advance of installation, and randomly test installed Work.

.4 Mock-up:

.1 Construct mock-up for each type of sealant to show location, size, shape, colours, and depth of joints complete with bond breaker, joint backing, primer, and sealant. Accepted mock-up may become part of finished Work.

.2 Remove mock-ups that do not form part of Work from Site during final cleanup, or when directed by Consultant.

.3 Allow [24 hours] [48 hours] for Consultant to review mock-up before proceeding with sealant Work.

.5 Pre-installation meetings:

.1 Conduct meetings 7 Days in advance of sealant installation.

.2 Include Consultant, sealant manufacturer’s representative, independent inspection and testing agency engaged by Contractor, and parties who are directly affected by the Work of this Section.

.3 Verify Contract requirements, substrate conditions, joint conditions and profile, weather conditions, and the manufacturer’s installation instructions.

.4 Within 72 hours following the pre-installation meeting, prepare a pre-installation meeting report and issue to all parties in attendance.

.1 Clearly indicate the recommendations made during the pre-installation meeting, the required actions, and by whom.

1.7 SITE CONDITIONS

.1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

1.8 DELIVERY, STORAGE HANDLING AND PROTECTION

.1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

.2 Receive and store materials as recommended by materials manufacturer.

.3 Maintain containers and labels in undamaged condition.

1.9 WARRANTY

.1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.

.1 Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

.2 Provide manufacturer's twenty-year material warranty for installed silicone sealant.

2 Products

2.1 MATERIALS – SEALANTS

.1 Type A:

.1 Single component, non-sag, non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 [As indicated on Contract Drawings.]

.2 [As selected by Consultant. Allow for more than one colour, for selection from the manufacturer’s full colour range, and for custom colours.]

.3 [To match adjacent substrate.]

.4 [To match existing.]

.3 Manufacturer’s Products:

.1 DOWSIL™ Contractors Weatherproofing Sealant (CWS) by Dow.

.2 Tremsil 400 by Tremco Sealants.

.3 Sikasil-N plus by Sika Canada Inc.

.4 SWS by GE Silicones.

.5 Pecora PCS by Pecora Corporation.

.2 Type B:

.1 Silicone joint sealant, in accordance with ASTM D5893/D5893M and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 [As indicated on Contract Drawings.]

.2 [As selected by Consultant. Allow for more than one colour, for selection from the manufacturer's full colour range, and for custom colours.]

.3 [To match adjacent substrate.]

.4 [To match existing.]

.3 Manufacturer's Products:

.1 Contractors Concrete Sealant (CCS) by Dow.

.2 Spectrem 900 SL by Tremco Sealants.

.3 Sikasil 728 SL by Sika Canada Inc.

.4 300SL by Pecora Corporation.

.3 Type C:

.1 Anti-microbial (mildew-resistant), non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 [White.]

.2 [Clear/translucent.]

.3 Manufacturer's Products:

.1 DOWSIL 786 by Dow.

.2 Tremsil 200 by Tremco Sealants.

.3 Sikasil-GP/GP HT by Sika Canada Inc.

.4 SCS1700 Sanitary by GE Silicones.

.5 Pecora 898NST by Pecora Corporation.

.4 Type D:

.1 Silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 50, and non-staining when tested in accordance with ASTM C510 or ASTM C1248. Suitable for structural glazing in accordance with ASTM C1184.

.2 Colour:

.1 [As indicated on Contract Drawings.]

.2 [As selected by Consultant. Allow for more than one colour, for selection from the manufacturer's full colour range, and for custom colours.]

.3 [To match adjacent substrate.]

.4 [To match existing.]

.3 Manufacturer's Products:

.1 DOWSIL 795 by Dow.

.2 Spectrem 2 by Tremco Sealants.

.3 Sikasil WS-295 by Sika Canada Inc.

.4 SCS2000 SilPruf by GE Silicones.

.5 Pecora 895NST by Pecora Corporation.

.5 Type E:

.1 Silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class +100/-50, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 [As indicated on Contract Drawings.]

.2 [As selected by Consultant. Allow for more than one colour, for selection from the manufacturer's full colour range, and for custom colours.]

.3 [To match adjacent substrate.]

.4 [To match existing.]

.3 Manufacturer's Products:

.1 DOWSIL 790 by Dow.

.2 Spectrem 1 by Tremco Sealants.

.3 SikaSil WS-290 by Sika Canada Inc.

.4 SCS2700 SilPruf LM by GE Silicones.

.5 Pecora 890NST by Pecora Corporation.

.6 Type F:

.1 Low dirt pick-up, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 50, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 [As indicated on Contract Drawings.]

.2 [As selected by Consultant. Allow for more than one colour, for selection from the manufacturer's full colour range, and for custom colours.]

.3 [To match adjacent substrate.]

.4 [To match existing.]

.3 Manufacturer's Products:

.1 DOWSIL 756 by Dow.

.2 Spectrem 3 by Tremco Sealants.

.3 Sikasil WS-295 by Sika Canada Inc.

.4 SCS9000 Silpruf NB by GE Silicones.

.5 Pecora 864NST by Pecora Corporation.

.7 Type G:

.1 Silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 50, and non-staining in accordance with ASTM C510 or ASTM C1248. General purpose type.

.2 Colour:

.1 [As indicated on Contract Drawings.]

.2 [As selected by Consultant. Allow for more than one colour, for selection from the manufacturer's full colour range, and for custom colours.]

.3 [To match adjacent substrate.]

.4 [To match existing.]

.3 Manufacturer's Products:

.1 DOWSIL Contractors Weatherproofing Sealant (CWS) by Dow.

.2 Tremsil 200 by Tremco Sealants.

.3 Sikasil WS-295 by Sika Canada Inc.

.4 SCS 1000 Contractors by GE Silicones.

.5 Pecora PCS by Pecora Corporation.

.8 Firestopping and Smoke Seals:

.1 Refer to Section 07 84 00 – Firestopping and Smokeseals.

2.2 COMPRESSIBLE SEAL

.1 Exterior Compressible seal:

.1 Silicone pre-coated, preformed, pre-compressed, self-expanding, binary sealant system of expanding polyurethane foam impregnated with water based, stabilized, polymer modified acrylic with factory applied silicone coated bellows, complete with field applied liquid silicone corner bead in matching colour, depth of seal as recommended by manufacturer. Use factory fabricated transitions and terminations pieces where joints change plane.

.1 Seismic Colorseal by Emseal Corporation, standard colour.

.2 Acoustic compressible seals:

.1 Preformed Foam Joint Sealant: Manufacturer's standard. Preformed, pre-compressed, open-cell foam sealant manufactured from urethane foam. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated.

.2 Acoustic compressible seals: coated on 2 sides for joints between opaque surfaces, coated on 3 sides for compression against clear surfaces.

.3 Product:

.1 At opaque materials: QuietJoint SHH by Emseal Corporation, or approved alternate.

.2 At clear materials: QuietJoint SHG by Emseal Corporation, or approved alternate.

2.3 ACOUSTIC SEALANT

.1 To ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 Product: Subject to compliance with requirements of this Section provide one of the following products:

.1 CP-506 by Hilti.

.2 Sheetrock Brand Acoustical Sealant by USG.

.3 AC-20 FTR or AIS-919 by Pecora; product as recommended by manufacturer for application indicated.

.3 Accessories: As recommended by manufacture to achieve minimum STC rating listed.

2.4 ACCESSORIES

.1 Primers:

.1 Type recommended by sealant manufacturer for substrate, to promote adhesion and to prevent staining of adjacent surfaces for conditions encountered.

.2 Joint backing:

.1 Extruded, round, solid section, skinned surface, closed cell, soft polyethylene foam gasket stock, compatible with primer and sealant materials.

.2 30% to 50% oversized.

.3 Shore A hardness of 20, tensile strength 140 kPa to 200 kPa, in accordance with ASTM C1330.

.4 Bond breaker type surface.

.3 Bond breaker tape:

.1 Polyethylene tape or other plastic tape recommended by sealant manufacturer to prevent sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

.2 Provide self-adhesive, pressure sensitive tape where applicable.

.3 Do not use material impregnated with oil, bitumen, non-curing polymer or similar deleterious material.

.4 Cleaning agents:

.1 Recommended by sealant manufacturer.

.2 Free of oily residues or other substances capable of staining or harming joint substrates and adjacent surfaces.

.5 Masking tape:

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

3 Execution

3.1 INSPECTION

.1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.

.2 Ensure masonry and concrete have cured 28 days minimum.

.3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.

.4 Verify that specified recommended environmental conditions are present before commending work.

.5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

.6 Do not start work of this Section until conditions are satisfactory.

3.2 PREPARATION

.1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.

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

.3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.

.4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.

.5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.

.6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.

.7 Prepare surfaces as recommended by sealant manufacturer.

.8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.

.1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.

.9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.

.10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.

.11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.

.12 Before any sealing is commended, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.

.13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.

.14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

3.3 INSTALLATION

.1 Perform Work in accordance with manufacturer’s recommendations for Products and applications indicated unless more stringent requirements apply.

.2 Use Products without additives or adulteration. Use one manufacturer's Product for each location in accordance with Sealant Location Schedule at end of this section.

.3 Perform Work in accordance with ASTM C1193, and ASTM C919 for Acoustic Sealant.

.4 Joint backing:

.1 Install joint backing to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

.1 Depth of recess: Maintain 2:1 joint width to depth ratio.

.2 Where recess is less than specified depth, cut back surface of recess to specified depth.

.2 Do not leave gaps between ends of joint backings.

.3 Do not stretch, twist, puncture, or tear joint backings.

.4 Remove absorbent joint backings that have become wet before sealant application and replace with dry materials.

.5 Support joint backing on horizontal surfaces against vertical movement which might result from pedestrian or vehicular traffic loads.

.5 Install bond breaker tape between sealant and back of joints where joint backing is not used.

.6 Apply sealant immediately after adjoining Work is in condition to receive sealant Work and as follows:

.1 Apply sealant in a continuous bead using gun with correctly sized nozzle. Use sufficient pressure to completely fill joint recess.

.2 Ensure sealant has full, direct uniform contact with, and adhesion to, side surfaces of recess. Superficial pointing with skin bead is not acceptable.

.7 Tooling:

.1 Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified to form smooth, uniform sealant bead, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains, or other defects.

.2 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.

.3 At recesses in flush surfaces, finish sealant with concave face and flush with face of material at each side.

.8 Immediately remove excess sealant and droppings.

.9 Ensure sealant bead is uniform in colour.

.10 Cure in accordance with the sealant manufacturer's recommendations. Do not cover up sealants until proper curing has taken place.

.11 Remove defective sealant and reapply.

3.4 SITE QUALITY CONTROL

.1 Joint Sealants: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1193, Method A – Field-Applied Sealant Joint Hand Pull Tab.

.1 Perform test no later than 21 days after installation at a rate of one test every 300 m of installed sealant.

.2 Structural Sealant: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1401, Method B – Hand-Pull Tab (Non-destructive).

.1 Perform five tests for first 300 meters of applied silicone sealant and one test for each 300 meters seal thereafter or perform one test per floor per building elevation minimum.

.2 For sealant applied between dissimilar materials, test both sides of joint.

.3 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.

.4 Maintain test log and submit report to Consultant indicating tests, locations, dates, results, and remedial actions.

.5 Maintain record of conditions and temperatures during application.

3.5 MANUFACTURER'S SITE SERVICES

.1 Require site attendance of each sealant manufacturers, during installation of the Work. Start sealant application in presence of manufacturer's technical representative.

.2 Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

.1 Clean surfaces adjacent to joints. Immediately remove sealant smears or other soiling resulting from application of sealants.

.2 Remove masking tape and other residue.

.3 Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

3.7 PROTECTION

.1 Protect joint sealants:

.1 During and after curing period from contact with contaminating substrates.

.2 From damages by construction operations or other causes.

.2 If damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated sealants immediately.

3.8 SEALANT LOCATIONS SCHEDULE

Type A	Above grade level, vertical applications
	- General perimeter caulking (window, doors and frames, louver frames, shelf angles, thresholds, bedding of mullions, precast and tilt-up panels). - Vertical expansion, control, lap joints application. - Painted metals. - Mullion joints. - Interior partition head to structure above. - Interior metal frames joints. - Exterior metal flashing. - Locations not indicated on Contract Drawings and required sealant for Work.

Type B	Above grade level, horizontal applications
	- Horizontal expansion joints. - Saw cut horizontal joints. - Precast slab horizontal joints. - Horizontal expansion and control joints in parking garages, plazas, terraces, decks, floors, and sidewalks.

Type C	Above grade level, horizontal and vertical applications
	- Around sinks, urinals, and bathroom fixtures. - Tiled areas' horizontal and vertical control and expansion joints. - Between vanity and mechanical fixtures/fittings. - Between access panels and tiles. - At corners of tiled walls.

Type D	Above grade level, horizontal and vertical applications

	- Structural glazing, horizontal and vertical. - Structural attachment of panel systems, horizontal and vertical. - Panel stiffener applications. - Suitable for wood, vinyl, and aluminum surfaces.

Type E	Above grade level, vertical applications
	- Precast wall vertical expansion joints. - Precast concrete panel vertical joints.

Type F	Above grade level, horizontal and vertical applications
	- Required non-staining to building materials. - Expansion and control joints in concrete panels, non-staining to building materials is required. - Metal curtain wall. - Porous surface including marble, granite, stone, and concrete, where non-staining to building materials is required. - EIFS. - Exterior and interior metal panels. - Masonry, where non-staining to building materials is required.

Type G	Above grade level, both vertical and horizontal
	- Glazing but not structural glazing. - Conventional glazing and replacement glazing of glass and plastic. - Aluminum sheet cover for insulation on metal pipes in exterior locations.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

.1 Exterior and Interior Steel Doors

.2 Exterior and Interior Steel Door Frames

.3 Sidelight Frames

.4 Fire rated door and frame assemblies

.5 Fire rated window frames

1.3 DEFINITIONS

.1 Base Metal Thickness: Thickness dimensions are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic coated steel sheets.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American National Standards Institute (ANSI):

.1 ANSI/SDI A250.7, Nomenclature for Standard Steel Doors and Steel Frames

.2 ANSI/SDI A250.11, Recommended Erection Instructions for Steel Frames.

.3 American Society for Testing and Materials (ASTM):

.1 ASTM A653/A653M, Standard Specification for Steel Sheet, ZincCoated (Galvanized) or Zinc Iron AlloyCoated (Galvannealed) by the HotDip Process

.2 ASTM A879/A879M, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

.3 ASTM A924/A924M, Standard Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 1.132-M90, Primer, Zinc Chromate, Low Moisture Sensitivity

.2 CAN/CGSB 41-GP-19M, Rigid Vinyl Extrusions for Windows and Doors

.3 CAN/CGSB 82.5-M88, Insulated Steel Doors

.5 Canadian Standards Association (CSA):

.1 CSA W59, Welded Steel Construction (Metal Arc Welding)

.6 Canadian Steel Door Manufacturers Association (CSDMA):

.1 Recommended Dimensional Standards for Commercial Steel Doors and Frames.

.2 Fire Labelling Guide.

.7 National Fire Protection Association (NFPA):

.1 NFPA 80, Standard for Fire Doors and Other Opening Protectives

.2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies

.8 Underwriters Laboratories Canada (ULC):

.1 CAN4 S104, Standard Method for Fire Tests of Door Assemblies

.2 CAN/ULC-S105, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

.3 CAN/ULC-S106, Standard Method for Fire Tests of Window and Glass Block Assemblies.

.4 CAN/ULC-S701.1, Standard for Thermal Insulation, Polystyrene Boards.

.5 CAN/ULC-S702.1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

1.5 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data:

.1 Submit product data for each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, fire resistance ratings, and finishes.

.2 Shop Drawings:

.1 Show each type of frame, door, hardware blanking, reinforcing, tapping and drilling arrangements, metal gauges, thicknesses and finishes.

.2 Show details of doors including vertical and horizontal edge details.

.3 Submit door and frame schedule identifying each unit. Each unit shall bear a legible identifying mark corresponding to that listed in the door and frame schedule.

.3 Samples:

.1 Supply for Consultant's review, if requested, sample of frame corner showing construction, workmanship and finish.

.4 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Source Quality Control Submittals: Submit information on zinc coating treatment and primer spot treatment, including instructions for surface treatment before site painting and any restrictions or special coating requirements.

.5 Certificates: Submit the following certificates or letters of compliance:

.1 Oversize Compliance: Submit oversize construction evidence indicating compliance with fire labelling for door and frame assemblies required to be fire protection rated and exceeding size limitations of labelled assemblies.

1.6 QUALITY ASSURANCE

.1 Manufacturer: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer, and as follows:

.1 Fabricate work of this Section to meet the requirements of the Canadian Steel Door and Frame Manufacturer's Association, Manufacturing Specification for Doors and Frames as a minimum, and as further modified in this section.

.2 Fabricator shall be a member in good standing of the Canadian Steel Door and Frame Manufacturer's Association.

.2 Supplier: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer.

.3 Installer: Use installers who are experienced with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.

.4 Testing Agencies: Provide doors produced under label service program of a testing agency acceptable to Authorities Having Jurisdiction, and as follows:

.1 Steel Fire Rated Doors and Frames: Labelled and listed by an organization accredited by Standards Council of Canada for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:

.1 List by nationally recognized agency having factory inspection service and construct as detailed in Followup Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.2 Fabricate all rated doors, frames and screens to labelling authority standard.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Adequately protect units against rust and damage during manufacture, delivery and storage.

.3 Store materials on planks in a dry area and cover to protect from damage. Make good immediately any damage done. Clean scratches and touch-up with rust-inhibitive primer.

1.8 SITE CONDITIONS

.1 Site Measurements: Verify actual dimensions of openings by site measurements before fabrication and indicate measurements on shop drawings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Measurements: Establish dimensions and proceed with fabricating doors and frames without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

2 Products

2.1 MATERIALS

.1 Sheet Steel:

.1 Exterior **[and Interior]** Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF180 (A60) zinc-iron-alloy (galvannealed) coating designation.

.2 Interior Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF120 (A40) zinc-iron-alloy (galvannealed) coating designation.

.2 Gauges:

.1 Door and Screen Frames:

.1 Gauge: 1.60 mm (16 msg)

.2 Doors (Honeycomb or Polystyrene Core):

.1 Door Faces:

.1 Gauge: 1.30mm (18 msg).

.3 Top and Bottom End Channels:

.1 Gauge: 1.30mm (18 msg).

.4 Reinforcements:

.1 Lock and Strike Reinforcements:

.1 Gauge: 1.60mm (16 msg).

.2 Hinge Reinforcements:

.1 Gauge: 3.51mm (10 msg).

.3 Flush Bolt Reinforcements:

.1 Gauge: 1.60mm (16 msg).

.4 Door Closer or Holder Reinforcements:

.1 Gauge: 2.74mm (12 msg).

.3 Anchors:

.1 As required to suit condition.

.4 Rubber Bumpers:

.1 3 per door.

.5 Door Cores:

.1 Honeycomb Core: Structural small cell; 25 mm (1") maximum, kraft paper honeycomb; minimum weight 36 kg/ream; minimum density 16.5 kg/m^3; sanded to required thickness.

.2 Insulation Core: [Rigid extruded, foamed-in-place, closed cell insulation, fire retardant treated meeting the requirements of ULC S701-11, Type 4, minimum thermal resistance RSI 0.79 per 25 mm (R-Value 4.5/1") thickness.]

.6 Adhesives:

.1 Core Adhesive: Heat resistant, single component adhesive recommended by manufacturer.

.7 Touch-Up Primer: Rust inhibitive primer meeting CAN/CGSB 1.132, touch up zinc coatings using shop applied primer; grey or red coloured primer, clear primer not acceptable; provide additional primer for site touchup to repair damaged zinc and shop applied coatings.

.8 Accessories:

.1 Glazing Stops:

.1 Glass mouldings: Formed steel having 0.8 mm (1/32") metal core thickness, screw fixed.

.2 Accurately fit and butt at corners glazing trim and stops; located on secure side of door, or interior of room window frame.

.2 Sealant: As specified in Section 07 92 00 – Sealants.

.3 Glass and Glazing: As specified in Section 08 80 00 – Glazing.

.4 Door Silencers (Bumpers or Mutes): Manufacturer's standard black or grey neoprene silencers; three silencers on strike jambs of single door frames; two silencers on heads of doubledoor frames; stick on bumpers are not acceptable.

.9 Materials for fire rated doors shall conform to ULC or ULI requirements.

.10 Thermal Break: Rigid polyvinylchloride extrusion.

2.2 FABRICATION AND MANUFACTURE

.1 Gauges of metal shall be as specified. No deviations or substitutions will be accepted.

.2 Reinforcing specified is the minimum acceptable. Provide additional reinforcement where required to ensure a permanent, rigid, trouble free installation able to withstand the stresses of heavy commercial usage.

.3 Cut, shear, straighten and work the steel in manner to prevent disfigurement of the finished work.

.4 Punch frames for rubber door bumpers.

.5 Fill seams, joints and weld depressions with epoxy metal filler, disc sand to a smooth, flat, uniform scratch-free surface, with all arrises sharp and true to line. Drilled and punches holes shall be reamed and have all burrs removed.

.6 Finished work shall be free of warp, open seams, buckles, weld and grind marks and other surface defects detrimental to the production of a good paint finish.

.7 Fastenings shall be concealed except those required for loose glazing stops.

.8 Welding shall conform to CSA W59.

.9 Hardware Requirements:

.1 Blank, mortise, reinforce, drill and tap doors and frames to receive templated hinges and other hardware as required. Check hardware lists for requirements.

.10 Frames:

.1 Fabricate frames to profiles shown. [Frames shall be fabricated to suite the header conditions of masonry work]. Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame. Fabricate header frame to suit. Where site welding or splicing is required due to size of unit, the location of field joints shall be shown on the shop drawings and strictly adhered to.

.2 Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.

.3 Cutouts in doors for mortise lock sets shall be fitted with leaf spring clips and back limit stop to facilitate easy positioning and setting of locksets.

.4 Weld floor clip angles to inside of each jamb profile, two holes in each for anchorage to floor. Where required provide adjustable type floor clip angles.

.5 Fit frames with channel or angle spreaders, two per frame, to ensure proper frame alignment. Install stiffener plates or spreaders between frame trim where required, to prevent bending of trim and to maintain alignment when setting and during construction.

.6 Where frames occur in masonry provide and adjustable T-strap type or wire type anchor for every 610mm (2'-0") of jamb length. Special anchors for frames to be set in concrete shall be as detailed.

.7 Construct door frames of labelled fire doors as approved by ULC or ULI. Ratings for frames shall match doors. Locate label on the frame jamb midway between the top hinge and the head of door frame so that it is concealed when the door is closed.

.8 Provide continuous weatherstripping at head and jambs of exterior door frames. Properly secure in place with screws and adjust as required.

.9 Insulate exterior frames to provide continuous thermal barrier in exterior frames.

.10 Fabricate thermally broken frames for exterior doors, separating exterior portion of frame from interior portion with polyvinyl chloride thermal breaks.

.1 Reinforce strike and hinge jambs with crimped 100 mm x 1.519 mm thick (4" x 0.060" thick) steel reinforcement spot welded to jamb returns at locations corresponding to hinge heights. Weld reinforcement to inside of jambs. Set reinforcement flush with outside of jambs.

.11 Doors:

.1 Fabricate doors to present one continuous face free from joints, tool markings and abrasions.

.2 Reinforce, stiffen honeycomb doors with small cell honeycomb core laminated to the inside faces of panels. The core shall completely fill the inside hollow of the door.

.3 Reinforce around frame openings required for glazing or louvers. Provide glazing stops with countersunk oval head screws.

.4 Exterior doors shall be completely filled with polystyrene foam core.

.5 Reinforce door edges with channel reinforcing. Bevel stiles 3 mm (1/8"). Assemble by tack welding and fill.

.6 Provide flush top edge on exterior doors.

.7 Fabricate fire rated door assemblies in accordance with ULC or ULI requirements. Provide labels for all fire rated doors. Locate label on the door midway between the top hinge and the head of the door so that it is concealed when the door is closed.

.8 Provide cutouts in doors for glazed lites as indicated on drawings and schedules. Glazing stops shall be square formed steel in single piece lengths sized to suit. Accurately mitre corners and finish in proper plane. Secure stops in place with flush, countersunk screws.

.12 Finishing

.1 Shop apply zinc rich primer to repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site; include compatible primer for site finishing and correction of surface abrasions to zinc coatings and factory applied primer.

.2 Remove weld slag and splatter from exposed surfaces.

.3 Fill and sand smooth tool marks, abrasions and surface blemishes to present smooth uniform surfaces.

3 Execution

3.1 EXAMINATION

.1 Examine substrates, door swing arcs, areas of installation and conditions affecting installation for compliance with requirements for manufacturer's installation tolerances and other conditions affecting performance of work of this Section.

.2 Verify roughing-in for embedded and built-in anchor locations before installing frames.

.3 Verify door and frame size, door swing and ratings with door opening number before installing frames.

.4 Installation of hollow metal doors and frames will denote acceptance of site conditions.

3.2 INSTALLATION

.1 Install steel doors, frames, and accessories in accordance with reviewed shop drawings, ANSI A250.11, CSDMA Installation Guide, manufacturer's data, and as specified in this Section.

.2 Door [and Window or Sidelight]Frames:

.1 Remove temporary spreaders before installing [door]frames, leaving exposed surfaces smooth and undamaged.

.2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm (1/16”) out of plumb measured on face of frame, maximum twist corner to corner of 3 mm (1/8”); align horizontal lines in final assembly.

.3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 1220mm (4’) and wider in accordance with ANSI A250.1; do not use temporary metal spreaders for bracing of frames.

.4 Install [glazing materials and] studded door silencers.

.5 For frames over 1220mm (4’) in width, provide vertical support at the centre of head.

.3 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:

.1 Squareness: Maximum 0.8mm (1/32”) measured across opening between hinge jam and strike jamb.

.2 Plumbness: Maximum 0.8mm (1/32”) measured from bottom of frame to head level.

.3 Alignment: Maximum 0.8mm (1/32”) measured offset between face of hinge jamb and strike jamb relative to wall construction.

.4 Twist: Maximum 0.8mm (1/32”) measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.

.4 Doors:

.1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.

.2 Install hardware in accordance with manufacturers' templates and instructions.

.3 Adjust operable parts for correct clearances and function.

.4 Install glazing materials.

.5 Install fire rated doors within clearances specified in NFPA 80-2010.

.6 Install louvers and vents.

.5 Adjusting and Cleaning

.1 Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of air-drying primer compatible with factory applied primer, and as follows:

.1 Clean exposed surfaces with soap and water to remove foreign matter before site touch-up.

.2 Finish exposed site welds to a smooth uniform surface and touch-up with site applied rust inhibitive primer.

.3 Site apply touchup primer on exposed surfaces where zinc coating or factory applied primer has been damaged during installation or handling.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

.1 Exterior Aluminum Doors and Frames

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 Aluminum Association (AA):

.1 Aluminum Design Manual, Latest Edition

.3 American Architectural Manufacturers Association (AAMA):

.1 AAMA 501, Methods of Test for Exterior Walls

.2 AAMA 611, Voluntary Specification for Architectural Anodized Aluminum

.3 AAMA 1503, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

.4 American National Standards Institute (ANSI):

.1 ANSI H35.1, Alloy and Temper Designation Systems for Aluminum

.2 ANSI/BHMA A156.1, Butts and Hinges

.3 ANSI/BHMA A156.3, Exit Devices

.4 ANSI/BHMA A156.4, Door Controls - Closers

.5 ANSI/BHMA A156.5, Cylinders and Input Devices for Locks

.6 ANSI/BHMA A156.6, Architectural Door Trim

.7 ANSI/BHMA A156.8, Door Controls - Overhead Stops and Holders

.8 ANSI/BHMA A156.16, Auxiliary Hardware

.9 ANSI/BHMA A156.21, Thresholds

.5 American Society for Testing and Materials (ASTM):

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

.2 ASTM A167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

.3 ASTM B209/209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.4 ASTM B221/B221M, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.5 ASTM B308/B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles

.6 ASTM B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

.7 ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

.8 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

.9 ASTM E783, Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

.10 ASTM E1105, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference

.6 Canadian Standards Association (CSA):

.1 CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels

.2 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures

.3 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.

.4 CSA W59, Welded Steel Construction (Metal Arc Welding), Metric.

.5 CSA W59.2, Welded Aluminum Construction

.7 Canadian Welding Bureau (CWB Group Industry Services):

.1 CWB 112E, Welding Symbols Study Guide

.2 CWB 113E, Weld Quality and Examination Methods Study Guide

.8 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International):

.1 Surface Preparation Guidelines:

.2 SSPC-SP COM Surface Preparation Commentary for Steel and Concrete Substrates

.3 SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems

1.4 QUALITY ASSURANCE

.1 The Contractor executing work of this section shall have a minimum of five (5) years continuous experience in the successful fabrication and installation of aluminum doors and frames of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 The installation shall be in conformity with laws, by-laws and regulations which govern the design and installation of aluminum doors and frames and the CSA, CGSB and ASTM standards specified.

.3 The work shall be supervised by competent foremen in the shop and during erection. Workmen shall be skilled in their respective trades.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meeting: Conduct a pre-construction meeting on site to review methods and procedures related to aluminum doors and frames including, but not limited to, the following:

.1 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings in accordance with the General Conditions.

.2 Related items shown on shop drawings which are not intended to be supplied as part of the work of this section, shall be so identified. All dimensions shall be clearly noted and methods of fastening and anchoring detailed. Show accurately and identify all adjacent materials.

.3 Drawings to show in full size detail all elements of assembly and construction including all variations of details required for aluminum doors and frames arrangement shown on the drawings. Design drawings shall bear the stamp of a professional engineer experienced in the design and fabrication methods pertaining to aluminum doors and frames.

.2 Samples:

.1 Submit full size section approximately 305mm (12") long of frame showing finish and profile for Consultant's review.

.3 Maintenance Data and Operating Instructions:

.1 On completion of work of this section, supply maintenance and glazing instructions for insertion in maintenance manual.

1.7 PROTECTION

.1 Protections of manufacturer's choice will be allowed, providing Consultant's approval is obtained, but manufacturer will be held responsible for staining and damage to aluminum work in case of failure of protection.

1.8 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any areas beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather.

.3 Exercise extreme care in handling units to prevent damage and scratched surfaces.

.4 Cover and protect the work of other sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.

.5 Be responsible for damage to the work until the building is complete and accepted by the Owner. In case of damage, material shall be completely removed and replaced with new.

.6 Provide safe and adequate equipment on the site to execute the work, hoisting, scaffolding, staging, safety protection equipment, tools, plant and other equipment required for the completion of the work.

1.9 WARRANTY

.1 Warrant work of this section against any defects in materials and workmanship in accordance with the General Conditions but for an extended period of ten (10) years and agree to promptly and without cost to Owner make good defects which become evident during warranty period. Without restricting the generality of the warranty, defects shall include leaking, deformation of members, breaking of glass due to thermal or structural movement, discolouration of finishes and failure of sealants.

.2 Warrant insulating glass units in accordance with General Conditions for a period of five (5) years. Warrant that units will be free from material obstruction of vision as a result of dust or film formation on internal glass surfaces by any cause other than extrinsic glass breakage.

.3 Warrant that any unit failing shall be removed and replaced without cost to the Owner.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar aluminum framed entrance and storefront systems may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Alumicor Limited

.2 Oldcastle Building Envelope

.3 Kawneer Canada Ltd

2.2 MATERIALS

.1 Aluminum:

.1 Extrusions: AA6063-T5 alloy, anodizing quality, conforming to ASTM B221-92a.

.2 Plate and Sheet: AA1100-H14 alloy, anodizing quality unless otherwise indicated minimum 3mm (0.125") thick, conforming to ASTM B209.

.3 Thresholds and Sills: AA6061-T6 alloy, anodizing quality, conforming to ASTM B221.

.4 Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off" marks, or other blemishes, whether left unfinished or finished.

.5 Aluminum Welding Materials: Conforms to CSA W59.2.

.2 Structural Steel Sections and Steel Plate:

.1 Conforms to CAN/CSA-G40.20/G40.21, Grade 300W. Hollow steel sections shall conform to CAN/CSA-G40.20/G40.21, Grade 350W, Class H.

.2 Steel Welding Materials: Conforms to CSA W59.

.3 Galvanized Steel Sheet:

.1 Commercial grade, stretcher levelled or temper rolled conforming to ASTM A525 with galvanized zinc G90 (Z275) coating conforming to ASTM A526/A526M.

.4 Insulating Glass and Spandrel Panel: As indicated in Section 08 80 00 – Glazing.

.5 Glazing Materials: As indicated in Section 08 80 00 – Glazing.

.6 Sealant Materials:

.1 Perimeter Sealant: Multi-component, chemical curing epoxidized polyurethane type sealant conforming to ASTM C920. Colour as selected later by Consultant.

.1 Dymeric 240 by Tremco (Canada) Ltd.

.2 CWS/CCS by Dow Corning

.3 or approved alternate.

.2 Threshold Sealant: Oil based sealant conforming to CAN/CGSB-19.6.

.3 Backer Rod: Round open cell foam, extruded polyethylene, Shore A hardness of 20, tensile strength 140 to 200 kPa, oversized 30-50%, compatible with sealant and primer, non-adhering to sealant.

.1 Ethafoam SB by Dow Chemical Canada Inc.

.2 Sof Rod by Tremco (Canada) Ltd.

.3 or approved alternate.

.4 Joint Primers: As recommended by sealant manufacturer.

.5 Solvents, Cleaning Agents and Other Accessory Materials: As recommended by sealant manufacturer in writing.

.6 Bond Breakers: Where required, shall be polyethylene tape as recommended by manufacturer of sealant in writing.

.7 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved alternate.

.8 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.9 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.10 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

.11 Fasteners: 304 stainless steel.

.12 Aluminum Flashings: As indicated in Section 07 62 00 – Prefinished Metal Flashing and Trim.

.13 Aluminum Sills:

.1 Extruded or formed type aluminum sills, minimum 2.4mm (3/32") thick, with three coat fluoropolymer thermal setting enamel finish to match aluminum caps.

2.3 ENTRANCE DOORS

.1 Manufacturer's extruded aluminum glazed doors for manual swing operation, reinforced as required to withstand traffic conditions.

.2 Exterior Door: Thermally broken frame sections, square stops for sealed glazing, non-removable glazing stops on exterior side.

.1 57mm (2-1/4”) deep, [with centre rail,] [narrow] [medium] [wide] stile.

.2 Insulclad by Kawneer.

.3 ThermaPorte by Alumicor.

2.4 DOOR HARDWARE

.1 Manufacturer’s heavy duty hardware units in sizes and types as required to meet entrance use as indicated on Drawings:

.1 Hinges: Stainless steel, butt hinges.

.2 Closers: Barrier free, overhead concealed, heavy duty, complete with integral stop arms or overhead door stops.

.3 Locks: Thumb piece on inside, high security deadbolt.

.4 Flushbolts, Pairs of Doors: Manual top and bottom concealed flush bolts.

.5 Push/Pulls: Full height and width of doors, round bar type, finish to match entrances.

.6 Weatherstripping: Manufacturer's standard pile type in replaceable rabbets for stiles; manufacturer's standard EPDM bulb type in door frames.

.7 Thresholds: barrier free, mill finish aluminum threshold with elastomer weather-strip and counterflashed.

.8 Electrified Security Hardware: As indicate in the door schedule on the drawings.

2.5 FABRICATION

.1 Fabricate aluminum-framed glass swing doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

.2 Fabricate aluminum-framed glass doors that are re-glazable without dismantling perimeter framing.

.1 Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.

.2 Accurately fit and secure joints and corners. Make joints hairline in appearance.

.3 Prepare components with internal reinforcement for door hardware.

.4 Arrange fasteners and attachments to conceal from view.

.3 Fit and assemble as far as possible in factory and fabricate with:

.1 Metal sections drilled, tapped, welded, braced as required for the proper installation and fixing of all components and accessories, and supplied complete with all necessary anchors, clips, bolts, screws, for the installation.

.2 Members possessing sharply defined profiles, straight, square and true with surfaces in proper planes and exposed finished surfaces and edges smooth and free from defects.

.3 Fabricate the components to accommodate and interface with work of other sections by means of rabbets, interlocks, miscellaneous angles, trim and filler sections as required.

.4 Framing, bracing, reinforcing and anchors having structural properties adequate to safely sustain and stresses to which they will be subjected.

.5 Provision for proper expansion and contraction.

.6 Joints and intersections shall be accurately formed and tightly fitted.

.7 Bolts tight and threads nicked to prevent loosening of nuts, bolting and screwed work made as inconspicuous as possible.

.8 Preparation for glazing as required.

.9 Fabricate aluminum entrances and sliding doors to dimensions and profiles as shown. Exposed surfaces shall be free of mechanical fasteners. Units shall be true rigid assemblies, square and free of any distortions.

.10 Cut, drill, tap and reinforce each sliding door for locks, casters, hangers and hardware. Lock cylinders will be supplied by hardware section.

.11 Accurately prepare and reinforce with backing plates to ensure adequate strength, cut-outs, recesses and mortising required for Best lock cylinders and other hardware. Install lock cylinders.

2.6 FINISHES

.1 Prefinish exposed to view aluminium surfaces. Ensure aluminium finish is free from blemishes or scratches and uniform in colour and sheen. Pretreat aluminium and apply primer and finish coats in accordance with manufacturer's instructions.

.1 Clear Anodic Finish: AA-M12C22A41, as fabricated nonspecular mechanical finish, medium matte etched chemical finish, architectural class I clear anodic coating of minimum 0.018 mm (0.7 mil) thick complying with AAMA 611.

.2 Steel (Concealed): Hot-dip galvanized, or zinc rich paint.

.3 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

3 Execution

3.1 PREPARATION

.1 Take field measurements from actual structure and verify prior to commencement of fabrication.

.2 Allow for dimensional tolerances and deviations from true planes permissible in the structural frame. Excessive deviations shall be reported to the Consultant in writing for correction. Commencement of the work implies acceptance of all conditions.

3.2 INSTALLATION

.1 Erection shall be carried out by competent and skilled installers employed by the manufacturer.

.2 Install swing door plumb, true and square complete with all necessary reinforcing and incidental components.

.3 All anchors and fastening to structure shall be designed to allow complete adjustment for levelling and positioning of the frame and for deflection and creep of the structure without imposing loads on the swing doors.

.4 The work shall be anchored and blocked as shown on the final shop drawings. Make provision for concealing anchors, clips, blocking and the like.

.5 Refer to drawings for location of each type of glass.

3.3 ADJUSTING

.1 Immediately prior to final cleaning of glass and before handing over building to Owner, make good damage and disfigurement to this work, remove protective coatings, stains and foreign matter from exposed exterior and interior surfaces of glass and aluminum and leave in first-class condition to Consultant's satisfaction.

.2 Clean using soap and water, or water and approved solvents not injurious to aluminum, glass, glazing and sealant compounds. Do not use abrasives.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the sectional overhead insulated metal doors with electric motor operated.

1.3 QUALITY ASSURANCE

.1 Design sectional overhead insulated metal doors to operate at 1 kPa wind pressure, without any detrimental effects.

.2 Regulatory Agencies: Provide laboratory tested products acceptable to the Authority Having Jurisdiction for the following criteria:

.1 Electrical: Provide electrical components, devices and accessories, motors, controls and wiring conforming to CSA Standards and CSA labelled.

.3 Installer and Manufacturer Qualifications:

.1 Work shall be executed by a firm having minimum five (5) years experience in successful manufacture and installation of work of type and quality shown and specified.

.4 Job Conditions:

.1 Protect during installation any adjacent finished surfaces from contamination and damage due to work under this section.

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.2 Product Data: Submit product data for each type and size of overhead coiling door and accessories.

.3 Shop Drawings:

.1 Submit shop and erection drawings in accordance with General Conditions.

.2 Show and describe in detail special door assemblies, including elevations, sections and detail of doors, track, hardware and operating components, and of relationship of door to adjacent construction including dimensions, gauges, thickness, description of materials, finishes, as well as all other pertinent data and information.

.4 Samples for Initial Selection: Submit manufacturer's colour charts showing full range of colours available for units with factory applied finishes for initial selection.

.5 Maintenance Data and Operating Instructions:

.1 Upon completion of installation, supply copies of data all as per General Conditions.

.6 Provide operating and maintenance data for incorporation into the Operating and Maintenance Manual.

1.5 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where overhead doors are required to fit within openings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating overhead doors without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

1.6 STORAGE, DELIVER, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

1.7 WARRANTY

.1 Warrant work of this section against defects in materials and workmanship in accordance with General Conditions but for three (3) years. Agree to make good promptly any defects which occur within this period.

1.8 ELECTRICAL CO-ORDINATION

.1 Electrical Requirements: Coordinate wiring requirements and power characteristics of work with building electrical system. Do wiring in strict conformity with requirements of the Electrical Code and Electrical Sections.

.1 Work by Electrical Sections: Supply and installation of disconnect switch/junction box and power to the disconnect switch/junction box.

.2 Work by This Section: Wiring and connection at and from disconnect switch/junction box to motors, starters, switches, controls, safety devices and other items requiring power.

.3 Coordinate and confirm building power as per electrical drawings and specifications.

.2 Employ licensed electrician to wire and interconnect all operational and safety components for the Work. Terminate wiring required for connection to control circuitry and power at NEMA enclosures. Ground all control wiring.

.3 Electrical Components, Devices, and Accessories: CSA certified and labelled.

2 Products

2.1 APPROVED PRODUCTS AND MANUFACTURERS

.1 This specification is based on the specified sectional steel, polyurethane laminated, overhead doors Thermatite 175 by Richards Wilcox Garage Doors (Canada). The following manufacturer's with similar function, profile, type, and performance may submit for Consultants to review for acceptance:

.1 Steel-Craft Door Products Ltd.

.2 Upwardor Corporation.

2.2 STEEL SECTIONS

.1 Door sections shall be constructed from Galvalume sheet steel, a corrosion-resistant embossed steel, coated with approximately 55% aluminum 1.6% silicone, with the balance being zinc.

.2 Door sections shall be manufactured by a continuous foamed-in-place polyurethane lamination process resulting in a homogenous sandwich of even-textured polyurethane insulation of metal/foam/metal construction to form a section 46 mm (1-13/16”) thick. Sections shall be roll-formed to produce a thermal break. Sections shall have a thermal resistance of minimum RSI of 2.15.

.3 Joints between sections shall be designed with pivotable round horizontal links to eliminate accumulated water from flowing down the inside of the door when opened.

.4 Sections shall be equipped with 2 mm (1/16") thick steel end caps for bracket and end hinge attachment.

2.3 WEATHER SEALS

.1 Thermal plastic rubber tube seal shall be fitted inside every joint between the sections to control air infiltration and exfiltration.

.2 Provide EPDM rubber head flexible seal fitted to an aluminum extruded strip to ensure proper seal against header door frame regardless of outside/inside temperature variances.

.3 Nylon jamb seal shall be provided on the vertical angle supporting the tracks to prevent contact between conductive metal surfaces, provide seal against wind, rain and heat loss and reduce friction.

.4 Provide EPDM rubber severe weather blade-type jamb seal. This seal shall attach to the nylon jamb seal retainer to form a weathertight seal against the outside skin of the door.

.5 Provide EPDM double-bottom sealing weatherstrip for manually operated doors. Door bottom weatherstripping shall conform to minor irregularities in the floor.

2.4 VISION PANELS

.1 Provide full section width vision panel insulated glass unit to locations in sectional overhead doors as indicated on drawings and schedules

.1 Insulated Glass Unit: Two panes 6 mm (1/4”) thick tempered glass panels to CAN/CGSB 12.1, Type 2, Class B with 13 mm (1/2”) sealed air space

2.5 TRACKS

.1 Tracks shall be 76 mm (3") heavy-duty gauge galvanized steel vertical lift track as indicated on drawings, designed for clearances shown. Provide complete track assembly including brackets, bracing and reinforcing for rigid support of the track for the required door type and size. Slope tracks at proper angle from vertical to ensure tight closure at jambs when the door is closed. Weld or bolt to track supports.

.2 Provide steel roll-formed track channel. Track channel shall allow temperature change movements of the door to take place when subjected to extreme temperature variance between inside and outside.

2.6 REINFORCEMENTS AND SUPPORTS

.1 Provide galvanized steel track reinforcement and support members. Secure, reinforce and support tracks as required for size and weight of door to provide strength and rigidity and to ensure against sag, sway and detrimental vibration during opening and closing of doors.

.2 Support and attach tracks at opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal tracks with continuous angle in accordance with manufacturer's specification for size and weight of door.

2.7 COUNTERBALANCING SYSTEM

.1 Doors shall be equipped with helical wound torsion springs having a minimum spring life of 100,000 cycles.

.2 Spring material shall be made of high tensile wire.

.3 Doors shall be supplied with solid steel shaft keyed the entire shaft length, in accordance with manufacturer's written instructions.

2.8 HARDWARE

.1 Provide heavy-duty fully adjustable roller brackets to each end reinforcement plate as per manufacturer's recommendations. The adjustable roller brackets are to provide an easy adjustment of the door to the jamb to achieve the proper seal. Use self-tapping fasteners to secure brackets to the door sections.

.2 Provide heavy-duty, rust-resistant hardware, with galvanized fasteners, to suit type of door.

.3 All bottom corner brackets shall be equipped with adjustable roller brackets. All brackets shall feature the locking wedge on the cable fastener for complete adjustments.

.4 Provide heavy-duty rollers, with 10 steel ball bearings in case-hardened steel races. Extend roller shaft through both brackets where double brackets are required. Provide roller tires to suit size of track.

2.9 CABLE DRUM

.1 Provide cast aluminum cable drums grooved to receive the proper diameter cable for the weight of the door with two extra safety wraps and dual locking screws.

2.10 OPERATION

.1 Door will be operated by means of motor operation. Optional pneumatic sensing edge to be attached to bottom bar to stop and reverse the door when it contacts an object during the closing cycle.

2.11 ELECTRONIC DOOR OPERATORS

.1 Electric Door Operator: Of suitable motor, designed by door manufacturer to operate doors of dimensions shown. Electrical motor and related components shall be supplied to suit voltage and other electrical characteristics of electrical system in building. 1/2 H.P., 208 volt, 3 phase, 60 Hz, complete with:

.1 Motor instantly reversible.

.2 Reversing, heavy duty, industrial type contactors with mechanical interlock.

.3 Solenoid operated brake.

.4 Quick release door arm.

.5 Pneumatic safety edge on bottom of door to reverse instantly on meeting an obstruction in downward travel.

.6 Take up reel for pneumatic safety edge.

2.12 LOCKING

.1 Electric-motor operation doors will lock through the operator gearing.

2.13 MISCELLANEOUS

.1 Provide all wood blocking, shims, bolts, washers, anchors, expansion shields, wiring, connectors and all other miscellaneous items necessary to complete the work of this section.

.2 Provide lift handles.

2.14 FINISHES

.1 All exposed steel surfaces shall be suitably cleaned and pre-treated. Apply one coat of manufacturer's standard shop primer. Ready for finish painting by Section 09 90 00 – Painting.

3 Execution

3.1 EXAMINATION

.1 Examine all areas of Work that affect the work of this section. Report in writing all errors, defects and discrepancies immediately to the Consultant.

.2 Commencement of work of this section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Install doors, tracks and operating equipment complete with necessary hardware, jamb and head mould stops, anchors, brackets and accessories. Install manually operated sectional overhead insulated metal doors where indicated on drawings.

.2 Mount counterbalance mechanism with manufacturer's fully adjustable ball bearing brackets at each end of shaft. Furnish torsion shaft centre support bearings as required for size and weight of doors.

.3 Fasten vertical track assembly to framing at maximum 610 mm (24") O.C.

.4 Install weather seals at heads, jambs and door bottoms as recommended by door manufacturer to form a continuous weathertight seal at door perimeter.

.5 Doors shall fit snugly to all edges of jambs and heads of frames and shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward.

3.3 ADJUSTMENT AND DEMONSTRATION

.1 Upon completion of work of this section, and when directed by the Consultant, adjust and lubricate sectional overhead doors, check and adjust controls, ensure that all equipment and mechanisms are operating smoothly, and demonstrate the operation, control and safety features of each door to the Consultant and the Owner.

3.4 CLEANING AND CLEAN-UP

.1 Clean and make good to the Consultant's approval, surfaces soiled or otherwise damaged in connection with the work of this section. Contractor shall pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.

.2 On completion of the work of this section, remove all debris, equipment and excess material from the site that results from the work of this section.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for design, supply and installation of glazed curtain wall system consisting of, but not limited to, the following:

.1 Curtain wall system.

.2 Connections to structural support systems, fasteners, and accessories required for a complete installation of the glazed aluminum curtain wall system.

.3 Cap extension.

.4 Mullion extensions.

.5 Integral air barrier and vapour retarder.

.6 Integral fire stops at floor slabs.

.7 Gap-filling foamed-place insulation.

.8 Perimeter sealant.

.9 Manufacturer's Site Services and Site Quality Control.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

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

.1 ASTM A36/A36M, Specification for Carbon Structural Steel.

.2 ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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

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

.5 ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.6 ASTM B22, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.7 ASTM E283, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.8 ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.

.9 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.

.10 ASTM E413, Classification for Rating Sound Insulation.

.11 ASTM E1105, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.2 American Architectural Manufacturers Association (AAMA):

.1 AAMA CW-10, Care and Handling of Architectural Aluminum From Shop to Site.

.2 AAMA CW-11, Design Wind Loads and Boundary Layer Wind Tunnel Testing.

.3 AAMA T1R-A1, Sound Control for Fenestration Products.

.4 AAMA 501, Methods of Test for Exterior Walls.

.5 AAMA 611, Voluntary Specifications for Anodized Finishes Architectural Aluminum.

.6 AAMA 612, Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.

.7 AAMA 2603, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

.8 AAMA 2604, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

.3 Canadian Standards Association (CSA):

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA S136, North American Specification for the Design of Cold Formed Steel Structural Members.

.3 CAN/CSA-S157/S157.1, Strength Design in Aluminum/Commentary on CAN/CSA-S157, Strength Design in Aluminum.

.4 CSA W59.2, Welded Aluminum Construction.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with installation of other Divisions, includes, but not limited to fire stopping, air barrier placement, flashing placement, and other components or materials.

.2 Pre-Installation Meetings:

.1 Convene pre-installation meeting 2 week prior to beginning work of this Section.

.2 Require attendance of the Consultant, Installer, Manufacturer, representatives of door systems to be installed in curtain wall system, and other parties directly affected by the work of this Section. Include inspection agency representative.

.3 Review:

.1 Curtain wall system drawings, specifications, and other contract documents affecting work.

.2 Submittals completed and yet to be completed.

.3 Materials, shop and site fabrication, installation requirements, and structural silicone joints.

.4 Required inspections, operational testing, and certifying procedures.

.5 Construction schedule related to other work affecting curtain wall installation and verification of availability of materials, Installer's personnel, equipment, and facilities required to make progress and avoid delays.

.6 Preparation and installation procedures and coordination and scheduling required with related work.

.7 Weather and forecasted weather conditions and procedures for coping with unfavourable conditions.

.4 Tour, inspect, and discuss conditions, connections to building structure, and other preparatory work performed by other installers.

.5 Prepare and distribute minutes of meeting to Owner and participating parties.

1.6 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design curtain wall system, including comprehensive engineering and thermal analysis by a qualified Engineer specialized in work of this section, using structural performance requirements and design criteria indicated herein.

.2 Compartmentalization seals to be air and water tight and capable of supporting design air pressure differences.

.3 System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with applicable code, when tested in accordance with ASTM E330.

.4 Design structural steel used for anchorage in accordance with CA/CSA-S16.1.

.5 Design curtain wall anchors to accommodate thermal, seismic, and building movements without causing detrimental effect to system components and sealants, and to have a minimum expected service life of thirty years in accordance with CSA S478.

.6 Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable code.

.7 Effects of Combinations of Loads: Design system to withstand the most unfavourable combinations of loads.

.8 Deflection: Design structural performance of aluminum components of curtain wall in accordance with CSA S157/S157.1.

.1 Deflection Normal to Wall Plane: Limit mullion deflection to L/175 or 19mm whichever is less for spans less than 4270mm; L/240 + 6mm for spans higher than 4270mm, with full recovery of glazing materials.

.2 Deflection Parallel to Glazing Plane: L/360 of clear span or 3 mm, whichever is smaller.

.9 Deflection limits for sheet metal and air vapour barriers shall be L/360 of span or maximum 6mm whichever is less, under design loading.

.10 System Assembly: Accommodate without damage to system, components or deterioration of seals, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, deflection of structural support framing, tolerance of supporting components, column shortening, long-term creep of structural members, story drift, and deflection from uniformly distributed and concentrated live loads.

.11 Air Infiltration: Limit air infiltration through assembly to 0.00015 cu m/sq m of wall area, measured at a reference differential pressure across assembly of 300 Pa or 6.24 PFF as measured in accordance with ASTM E283.

.12 Water Leakage:

.1 Design system to provide resistance to water entry as evaluated by the following test procedures:

.1 Static Water Infiltration – No leakage at 720 Pa when tested to ASTM A331 or ASTM 1105

.2 Dynamic Water Infiltration – No leakage at 720 Pa when testing to AAMA 501.1

.13 Condensation Resistance: Prevent condensation and frost on inside surfaces of system when subject to outside temperature of minus 25 degrees C and 24 kph wind speed and inside temperature of 21 degrees C when interior relative humidity is 30 percent in a temperature index of 60 in accordance with CSA-A440-00.

.14 Expansion / Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 100 degrees C over a 12 hour period without causing detrimental effect to system components.

.15 Surface Temperature: System to be capable of withstanding metal surface temperature range of 110 degrees C without buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance. Design frames so that edges of inner pane of insulating glass units do not fall more than 8 degrees C below the temperature of the centre of the inner pane.

.16 System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

.1 Inconspicuously locate vents and drain holes to prevent staining, streaking or marking of glass or framing. Size vents to provide instantaneous pressure equalization. Provide baffles to vent openings to prevent direct rainwater entry.

.2 Incorporate vertical and horizontal compartments behind exterior caps and frame-supported structural sealant glazed joints to suit spatial distribution of wind pressures.

.3 Glazing pockets vented and drained to the exteriors.

.4 All exposed end of mullions and caps to be capped and sealed while not compromising drainage quality.

.17 Air and Vapour Seal: Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapour retarder. Locate air seals to prevent contact between interior humid air and exterior cold air and structure components, and to prevent moisture accumulation on these surfaces during cold weather.

.18 Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

.19 Provisions for Movement of System: Unless otherwise indicated, provide the following.

.1 Refer to structural engineer drawings and specification for design criteria.

.20 Design glass and glazing in accordance with requirements listed below:

.1 Coordinate with the glass and glazing types as specified in Section 08 80 00.

.2 Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with the Building Code and to withstand design pressures specified in applicable sections.

.3 Where glass extends from 1070 mm to floor, design lateral loads, in addition to other load requirements, in accordance with applicable codes.

.4 Unless otherwise specified, limit glass deflection to L/175 or flexure limit of glass with full recovery of glazing materials, whichever is less.

.5 Provide tempered, laminated, laminated-heat strengthened and heat soaked glass and related fittings and hardware in doors, side lights, screens, storefronts, glazed curtain walls, and glazed guard rails accordance with applicable codes and as indicated or scheduled.

.1 Unless otherwise specified or indicated, provide tempered glass where sill of glass is less than 300 mm above finished floor.

.2 Unless otherwise specified or indicated, provide laminated-heat strengthened and heat soaked glass where glass is a guard.

.6 Sealed Insulating Glass Units: Provide units free of the following characteristics:

.1 Appearance of condensation between panes.

.2 Obstruction of vision at unit perimeter.

.3 More than 10 percent measurable deterioration of thermal transmission or shading coefficient values.

.4 Chipping, cracking, or breakage of glass panes occurring due to manufacturing defects or under specified service conditions.

.5 Migration of edge spacer.

.6 Migration of low E coating into edge spacer.

.21 Joint Movement Capability between System and Adjacent Construction: Design expansion joints with movement capability as specified Structural Consultant's specifications or as indicated, but not less than plus or minus 50 percent of joint width, without detrimental effects to assembly and adjacent construction.

1.7 SUBMITTALS FOR REVIEW

.1 Provide submittals in accordance with Section 01 33 00 –Submittal Procedures.

.2 Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow drainage diagrams.

.3 Shop Drawings:

.1 Shop drawings shall bear the professional seal and signature of a Professional Engineer licensed to design structures and registered by authority having jurisdiction in the location of the Work.

.2 Furnish complete shop and erection drawings required for the work of this Section to the Consultant for review prior to fabrication.

.3 Co-ordinate shop drawings for work of this Section with those for other trades to ensure correct interface details required to provide watertight installation.

.4 Shop drawings shall incorporate plans, elevations, sections and details for all work in this Section. The details shall show and specify all metal and glass thicknesses, types and finishes, areas to be sealed and sealant materials, gaskets, glazing methods, direction and magnitude of thermal expansion, type of construction including joinery, fasteners and welds, all anchorage assemblies and components, the fabrication and erection tolerances for the work in this Section and the adjoining related work of other Sections.

.5 Submit structural calculations certified by a Professional Engineer licensed to design structures and registered by authority having jurisdiction in the location of the Work, substantiating sizes for members and connections based on the design loads before commencing fabrication.

.4 Samples:

.1 Submit duplicate minimum 300 mm x 300 mm samples of each type of aluminum finish specified.

.2 Upon Consultant's request furnish samples of glass types, gaskets, tapes and sealants.

1.8 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For Manufacturer and Installer. Include proof of adequate facilities and capacity to produce work.

.2 Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory, which purport to meet performance criteria, and other supportive data. Include reports for insulating glass units and structural silicone sealant in accordance to CGSB 12.8. Test report to be within 5 years from current date.

.3 Submit test reports of the insulating glass units to be supplied as prescribed in CAN/CGSB-12.8 showing successful results. Tests shall be conducted and reports prepared by an approved, independent testing laboratory. Test report to be within 5 years from current date.

.4 Sealant Manufacturer’s Certificates: Certifying that:

.1 Sealant materials selected for use are from those specified in accordance to ASTM C794.

.2 Surface preparation and application requirements have been reviewed to suit Project requirements, and instructions given to installers.

.3 Sealants are compatible with other materials and products in curtain wall assembly and adjacent construction.

.5 Installation Data: Special installation requirements.

.6 Submit Quality Control Manual outlining quality control procedures and practice encompassing all aspects of curtain wall production and installation.

.7 Submit sealant manufacturer’s sealant compatibility statement that all materials in contact with structural sealants are compatible with the sealants in accordance with ASTM C1087. Submit sealant manufacturer’s statement and test data confirming that sealant stress is less than 138 kPa and a safety factor of 5:1.

.8 Submit glass thermal and wind load stress analysis documenting adequate glass thickness and/or heat treatment to meet stresses generated. Thermal stress analysis to consider effects of external and internal shading, conduction at glass edge, and contribution of low-e coatings.

.9 Submit finish coating manufacturer’s data: Name, address, phone number, and web site address of coating suppliers and applicators.

.10 Submit results of thermal modeling of all critical and typical cross-sections to assess both overall U value and establish condensation resistance. Results to be submitted in a format acceptable to Consultant.

.11 Professional Structural Engineer’s Letters of Assurance:

.1 Provide letters or completed prescribed forms signed by a professional structural engineer licensed in the Province where the Project is located, certifying that the curtain wall system has been designed, fabricated and installed in accordance with the structural performance requirements of this section and of the applicable codes, including verification that:

.1 Specified products have been used.

.2 Designs and installations as tested, have been installed on the Project.

.3 Loads and movement requirements have been achieved.

.4 Curtain wall framing designed as guards conforms to the applicable code.

.5 Summary of Design and Field review requirements.

.2 The engineer who sealed the shop drawings shall provide field review of installation and shall provide sufficient reviews in order to provide letters of professional assurance.

1.9 CLOSEOUT SUBMITTALS

.1 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with Manufacturer.

.2 Maintenance Data: For glazed aluminum curtain walls and windows; include instructions for re-glazing and as follows:

.1 Instructions covering re-glazing, adjustments, recommended cleaning procedures and other relevant maintenance data.

1.10 QUALITY ASSURANCE

.1 Perform Work in accordance with AAMA - Aluminum Curtain Wall Design Guide Manual.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum five (5) years' documented local experience, and employing a qualified Building Envelope Consultant experienced in the Province where the Project is located.

.3 Installer Qualifications: Company specializing in performing the work of this Section with minimum five (5) years' documented experience, and approved by manufacturer.

.4 Glass and glazing work under this section shall conform to the Insulating Glass Manufacturers Alliance and to the recommendations of the glass and sealed unit manufacturers.

1.11 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Handle work of this Section in accordance with AAMA - Curtain Wall Manual CW-10.

.2 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

.3 Assembled units and their component parts shall be transported, handled and stored in a manner to preclude damage of any nature.

.4 Ship and store pre-glazed units in upright position only or use method which will positively prevent extrusion of sealants and shifting of glass within framing.

.5 Accessory materials required for erection at the site shall be delivered to the site in manufacturer's labelled containers.

.6 Remove all units or components which are cracked, bent, chipped, scratched or otherwise unsuitable for installation and replace with new.

1.12 SITE CONDITIONS

.1 Provide safe and adequate equipment on the site to execute the work of this Section, including scaffolding, staging, hoisting, safety protection equipment, tools, plant and other equipment required for the completion of the work of this Section.

.2 Coordinate and verify, by measurement at the job site, all dimensions affecting the work of this Section. Submit written notifications to the Consultant any field dimensions and conditions which are at variance with those on the reviewed shop drawings. The decision regarding corrective measures shall be obtained from the Consultant prior to the fabrication of the item affected.

1.13 WARRANTY

.1 Provide a five (5) year warranty to correct defective Work; include coverage for complete system against failure to meet specified requirements.

.2 Provide ten (10) year manufacturer warranty for glazed units as specified in Division 08 Section Glass Glazing.

.3 Provide ten (10) year manufacturer warranty for metal finishes. Failures shall include excessive fading, non-uniformity of colour, cracking, peeling, delamination and corrosion.

.4 Warranties shall include removing and replacing covering and adjacent components and finishes. Warranty period shall recommence on remedied work.

2 Products

2.1 MATERIALS

.1 Aluminum:

.1 Extrusions: AA6063-T5 alloy, anodizing quality, conforming to ASTM B221-12.

.2 Plate and Sheet: AA1100-H14 alloy, anodizing quality unless otherwise indicated minimum 3 mm (0.125") thick, conforming to ASTM B209-10, with special hardness for flat aluminum spandrel panels.

.3 Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off" marks, or other blemishes, whether left unfinished or finished.

.2 Structural Steel Sections and Steel Plate:

.1 CSA-G40.20/G40.21, Grade 260W.

.3 Galvanized Steel Sheet:

.1 Commercial grade, stretcher levelled or temper rolled, with galvanized zinc G90 (Z275) coating conforming to ASTM A653/A653M.

.4 Glass: Refer to Section 08 80 00 – Glazing and as specified in this section for insulated glass units.

.5 Insulation Materials:

.1 Mineral Wool Insulation for Curtain Wall: Refer to Section 07 21 13 – Board Insulation.

.2 Spandrel Panel Insulation Fasteners: Adhesive bonded pin and disc type insulation fasteners as per 07 21 13 - Board Insulation.

.6 Sealants:

.1 Perimeter Sealant and Backing Materials: As specified in Section 07 92 00 – Sealants. Colour to be selected by Consultant.

.2 Sealant Used Within System (Not Used for Glazing): Silicone sealant as recommended by curtain wall manufacturer, and with VOC content less than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

.3 Sealing Tape for Inner Face Metal Panels of Infill Panels: Extruded polyisobutylene, ribbon-shaped, non-drying, non-skinning, non-oxidizing, reinforced, width and thickness to suit application but not less than 6 mm wide, designed to provide continuous seal.

.1 Product: ‘Tremco 440 Tape’ by Tremco, ‘Weatherban Sealer’ by 3M Canada, or approved equivalent.

.4 Structural Silicone Sealant: As specified in Section 07 92 00 – Sealants.

.7 Firestopping: As specified in Section 07 84 00 – Firestopping and Smokeseals.

.8 Air Vapour Barrier: As specified in Division 07 Section Air Barrier Membrane.

.9 Gap-filling foam Insulation: CAN/ULC-S710.1 single-component or CAN/ULC-S711.1 two-component, low VOC, low expansion bead-applied polyurethane based insulating foam sealant providing an air-tight vapour retardant flexible seal compatible with the air vapour retarder system specified in Division 07 Section Air Barrier Membrane ; the Gap-filling foam insulation system as specified in Division 07 Section thermal insulation and as recommended by Manufacturer.

.10 Zinc Rich Paint:

.1 Ready mixed, zinc rich primer conforming to CAN/CGSB-1.181, 'Sealtight Galvafroid Zinc-Rich Coating' by W.R. Meadows of Canada Limited, or 'Zinc Clad No.7 Organic Zinc Rich Primer' by Sherwin Williams Company of Canada Ltd.

.11 Bituminous Paint:

.1 Conforms to CAN/CGSB-1.108, Type 2.

.12 Fasteners: '400' Series stainless steel, or '300' Series stainless steel.

.13 Flexible Flashings: Flexible EPDM rubber sheet, minimum .060" (60 mils) thick, by Lexcan Limited, or by Dunlop Construction Products Inc., or by Firestone Building Products Company, or approved equal.

.14 Provide door adapters and other components as required to complete the work of this Section.

2.2 CURTAIN WALL SYSTEM

.1 Subject to conformance with requirements, provide the basis of design curtain wall assemblies manufactured by Kawneer North America , or approved equivalent systems from acceptable manufacturers listed.

.1 Standard Fully Captured System: 1600 UT System 1 Series.

.2 2 sided SSG Curtain Wall System: 1600 UT System 2 Series.

.3 Captured System for Intersect with Partition: Custom Veneer System.

.2 Other acceptable manufacturers: The following manufacturers' products meeting the Performance Requirements specified.

.1 Alumicor Limited.

.2 Oldcastle Building Envelope.

.3 US Aluminum.

.4 Northern Façade.

2.3 FABRICATION – GENERAL

.1 Fit and assemble component parts in shop as far as practicable. Work that cannot be permanently shop assembled shall be fitted, assembled, marked and disassembled to assure proper fitting in field. Identify shop assembled components on shop drawings for location and erection at Site.

.2 Aluminum components shall be extruded sections and shapes, unless otherwise specified or shown.

.3 Components required, for which extruded sections are not available shall be accurately formed to profiles indicated. Use minimum 1.62 mm (14 gauge) sheet aluminum unless otherwise indicated.

.4 All fastenings and connections shall be concealed unless approved by Consultant.

.5 Joints between horizontal and vertical mullions shall be accurately cut and fitted. Horizontal and vertical mullions shall be in true plane with interior and exterior faces in line.

.6 Mechanically joined sections shall have "hairline" joints.

.7 Reinforce members as required to withstand loads and to maintain deflection within allowable limits.

.8 Internally reinforce framing members where work of other trades is to be fastened thereto.

.9 Fabricate expansion joints between mullion sections with formed extruded aluminum internal sleeve sections, secure to permit joint function and maintain true alignment of sections.

.10 Install air cut-offs in continuous vertical members to prevent stack effect of enclosed air columns.

.11 Framing members shall have internally formed keyed slots to receive and retain preformed gaskets, seals and thermal separators.

.12 Pressure plates shall be designed with integrally formed keyed slots to receive seals and of thickness necessary to provide permanent, uniform, sealing pressures for glazing units, without deformation.

.13 Provide inconspicuous, baffled weep holes to properly drain curtain wall cavities to exterior.

.14 Fabricate system to accommodate and interface with work of other Sections by means of rabbets, interlocks, miscellaneous angles, trim and filler sections as required.

.15 Factory glaze system modules as far as practicable. Effect glazing seal in accordance with wall system and glass manufacturer's recommendations and so as to meet specified design and performance requirements.

.16 Fabricate extruded or formed aluminum sills to profiles indicated to suit wall condition and minimum 2.4 mm (3/32") thick. Provide drip deflectors at sill ends and at abutting vertical surfaces. Open ends of sills shall be fitted with neatly applied closure plates. Anchors shall be designed not to work loose after installation. Unless otherwise detailed provide "flush" slip joint at intermediate sill joints.

.17 Prepare aluminum curtain wall framing for installation of doors, finish door hardware including, but not limited to; deadlocks, handicap power door operators and other door finish hardware as specified within these documents.

.18 Install all door hardware on doors. Test all doors on completion of installation and adjust as required for smooth and efficient operation.

.19 Form covers, closures, mouldings and trim integral with, or immediately adjacent to work of this Section to profiles indicated on drawings, and as required for a complete installation.

2.4 FINISHES

.1 Aluminum Finish:

.1 Clear Anodic Finish: AA-M12C22A41, as fabricated nonspecular mechanical finish, medium matte etched chemical finish, architectural class I clear anodic coating of minimum 0.018 mm (0.7 mil) thick complying with AAMA 611.

.2 Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

.3 Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610 g/sq.

.4 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.

3 Execution

3.1 EXAMINATION

.1 Check structural elements and adjoining work of other Sections on which work of this Section is dependent, verify governing dimensions, floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frame. Confirm that conditions are satisfactory

before proceeding. Commencement of work of this Section indicates acceptance of surfaces and conditions.

3.2 ERECTION

.1 Erect curtain wall system plumb, level and square, in correct relation to work of other Sections, within a maximum non-cumulative deviation of 1/8" per 12'-0" length of member, and with members accurately fitted and aligned at joints and intersections.

.2 Anchor system to building structure, adjusting as required to meet erection tolerances and secure to prevent movement other than that which is expected due to structural deflection and creep and thermal expansion and contraction.

.3 Provide all devices and components required for erection of system.

.4 Provide flashings, fillers, covers and sealants indicated and as required to render system weathertight and to meet specified performance criteria. Ensure effective seal at laps, end joints and changes of direction.

.5 Provide continuity of thermal and air seal/vapour barriers with adjacent thermal and air seal/vapour barrier systems. Pack spaces between frames and adjacent building elements and where shown with fibrous insulation.

.6 Install glass panels and glazing materials in accordance with Section 08 80 00 – Glazing, to glazing method required to achieve performance requirements.

.7 Seal joints between wall system and adjacent building elements with sealant in strict accordance with requirements of Section 07 92 00 – Sealants.

.8 Use concealed fastenings only.

.9 Touch up steel anchoring components, after installation, with zinc rich paint.

3.3 ERECTION TOLERANCES

.1 Install glazed aluminum curtain wall systems to the following maximum tolerances:

.1 Plumb: 3 mm (1/8") in 3000 mm (10') with aggregate total not exceeding 6 mm (1/4") in 12.2 m (40’).

.2 Level: 3 mm (1/8") in 6 m (20') with aggregate total not exceeding 6 mm (1/4") in 12.2 m (40').

.3 Alignment: Limit misalignment of two adjoining glass panes abutting in the same plane as follows:

.1 Limit offset from true alignment to 1.5 mm (1/16") where surfaces meet in-line or are separated by reveal or protruding element up to 12 mm (1/2") wide.

.2 Limit offset from true alignment to 3 mm (1/8") where surfaces are separated by reveal or protruding element from 12 mm (1/2") to 25 mm (1") wide.

.3 Limit offset from true alignment to 6 mm (1/4”) where surfaces are separated by reveal or protruding element of 25 mm (1") or wider.

.4 Joint Width: Maintain sealant space between glass and adjacent construction to an average of 5/8", with a variation of no more than +3 mm (1/8") and 6 mm (1/4").

.5 Location: Limit variation from plane to 3 mm (1/8") in 300 mm (12") with aggregate total not exceeding 12 mm (1/2") over total length.

3.4 MANUFACTURER'S SITE SERVICES

.1 Curtain wall product manufacturer to provide field surveillance of the installation of their Products.

.2 Schedule manufacturer’s review of work procedures at stages listed:

.1 Product Application: 1 off site review.

.2 Fabrication and Handling: 1 review at authorized installers fabrication facilities.

.3 Installation: 3 site reviews at commencement of Work; 50% completion of Work and upon completion of Work.

.3 Submit manufacturer's written reports to Consultant describing:

.1 The scope of work requested.

.2 Date, time and location.

.3 Procedures performed.

.4 Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions.

.5 Limitations or disclaimers regarding the procedures performed.

.6 Obtain reports within seven days of review and submit immediately to Consultant.

.4 Monitor and report installation procedures and unacceptable conditions.

3.5 SITE QUALITY CONTROL

.1 Professional Structural Engineer Inspections: Engage professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located, to perform inspections.

.1 Perform timely and regular inspections.

.2 Verify installation conforms to applicable building code.

.3 Prepare and submit inspection forms required by applicable building code.

.2 Curtain Wall Tests and Inspections:

.1 Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C1401 using Destructive Test Method A, Hand Pull Tab (Destructive), Appendix X2.

.1 Test minimum of four areas on each building face.

.2 Repair installation areas damaged by testing.

.2 Structural-Sealant Glazing Inspection: After installation of metal-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to recommendations in ASTM C1401.

.3 Remove and replace nonconforming work and retest as specified at Contractor's cost.

3.6 FINAL CLEANING

.1 Remove protective coatings and coverings from prefinished components; clean structural components and fittings; remove excess sealants and other substances that detract from finished appearance after completion of installation.

.2 At completion of work of this Section, remove all labels from glass and clean inner and outer faces of glass and all exposed metal surfaces at interior and exterior. Replace scratched or broken glass and make good any damaged materials, all in accordance with Section 01 70 00.

.3 Coordinate protective measures required to prevent damage or deterioration of structural glass system from subsequent construction activities.

3.7 PROTECTION OF FINISHED WORK

.1 Protect finished Work from damage.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

1. General Conditions, Supplementary Conditions and Division 01 – General Requirements apply to this Section.

1.2 SUMMARY

1. Provision of all labour, materials, equipment, and incidental services necessary to supply finish hardware, including the following:
    1. Supply and delivery to the project all items of architectural finishing hardware specified herein,
    2. Supply and installation of low-energy door operators and hardware,
    3. Supply and installation of all electrical hardware items including, but not limited to; low voltage wire (FT6 plenum-rated when not in conduit), maglocks, electric strikes, electric exit devices, current transfer devices, wall switches, jamb switches, keypads, controllers, power supplies, and
    4. Completion of all low voltage terminations by the hardware supplier

1.3 RELATED REQUIREMENTS

1. Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

1. All references standards specified herein imply the latest edition of the standards
    1. ANSI-A250.4 - Steel Doors and Frames Physical Endurance
    2. ANSI A156.1 - Butts and Hinges
    3. ANSI A156.3 - Exit Devices
    4. ANSI A156.4 - Door Controls - Door Closers
    5. ANSI A156.5 - Cylinders and Input Devices for Locks
    6. ANSI A156.5 - Auxiliary Locks and Associated Products
    7. ANSI A156.6 - Architectural Door Trim
    8. ANSI A156.7 - Template Hinge Dimensions
    9. ANSI A156.8 - Door Controls - Overhead Holders
    10. ANSI A156-10 - Power Operated Pedestrian Doors
    11. ANSI A156.13 - Mortise Locks and Latches
    12. ANSI A156.14 - Sliding and Folding Door Hardware
    13. ANSI A156.15 - Closer Holder Release Devices
    14. ANSI A156.16 - Auxiliary Hardware
    15. ANSI A156.18 - Material and Finishes
    16. ANSI A156.19 - Power Assist and Low Energy Power Operated Doors
    17. ANSI A156.21 - Thresholds
    18. ANSI A156.22 - Door Gasketing and Edge Sealing Systems
    19. ANSI A156.25 - Electrified Locking Devices
    20. ANSI A156.26 - Continuous Hinges
    21. ANSI A156.30 - High Security Cylinders
    22. ANSI A156.31 - Electric Strikes and Frame Mounted Actuators
    23. ANSI A250.4 - Steel Doors and Frames Physical Endurance
    24. NFPA 80 - Standard for Fire Doors and Other Opening Protectives
    25. NFPA 101 - Life Safety Code
    26. ANSI A117.1 - Accessible and Usable Buildings and Facilities

1.5 DEFINITIONS

1. Architectural Hardware Consultant (AHC): person or persons skilled in selecting, coordinating, and specifying architectural hardware, and certified by the Door and Hardware Institute.
2. Hardware Supplier: company or group of companies whose purpose is the manufacture and supply of architectural finish hardware.
3. Hardware Distributor: company whose purpose is the distribution of architectural finish hardware.

1.6 QUALITY ASSURANCE

1. Products
    1. Products specified herein are minimum standard. Approved substitutions are listed. Products proposed as substitutions must be accepted by addenda prior to Bid Closing.
2. Hardware for doors in fire separations and exit doors must be certified by a Canadian Certification Organization accredited by Standards Council of Canada. Supply only ULC and/or CSA listed electrical components.
3. Hardware Suppliers
    1. Hardware Suppliers must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.
    2. The Hardware Supplier will provide following services to the Contract:
        1. preparation of the hardware schedule issued for tender,
        2. review of all shop drawings,
        3. provision of requested samples,
        4. review of hardware substitution submittals, and
        5. provision of all inspections and reports as specified herein.
4. Hardware Distributors
    1. The Distributor must have a minimum of five (5) years documented experience in the supply of Finish Hardware for similar projects.
    2. Hardware Distributors must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.
    3. The Hardware Distributor will assume responsibility that the Products supplied under this section meet or exceed the minimum requirements of the specifications, the hardware schedule, and all authorities having jurisdiction.
5. Installers
    1. Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. The Contractor shall provide verification of installer's qualification to the Consultant for approval. Installers to attend all review meetings with the Hardware Supplier and Distributor.
6. Pre-installation Meeting
    1. Convene a pre-installation meeting for the work specified in this section. Attendees must include, as a minimum, representatives of the following:
        1. Contractor (Site Superintendent & Project Manager)
        2. Installation Subcontractor (Site Foreman & Project Manager)
        3. Hardware Supplier (AHC)
        4. Hardware Distributor (AHC and Installer)
        5. Related Subcontractors (i.e.. Electrical, Security Systems)
        6. Consultant

1.7 SUBMITTALS

1. Updated Finish Hardware Schedule
    1. Prepare and submit a detailed hardware schedules prepared in 216mmx279mm DHI format.
2. Product Data
    1. Provide product data sheets with the finish hardware schedule showing all items of hardware to be used on the project.
3. Samples
    1. When requested in writing, provide one sample of each hardware item requested complete with fasteners to the office of the Consultant. Samples to be clearly labeled with their hardware schedule designation and manufacturers' name and model number. Samples may be incorporated into the Work.
4. Templates
    1. Provide other sections with complete sets of hardware templates for related fabricating and installation.
5. Keying Schedule
    1. Provide keying schedule for review. Include all special keying notes and stamping instructions. Locks and cylinders are not to be ordered until the key schedule has been approved by the Owner.
6. Wiring Diagrams
    1. Provide a written description of the functional use of all electrical hardware. Include door and frame elevations showing the location of each item of electrical hardware to be installed, including a diagram showing number and size of all conductors. Include drawings showing all terminal connections. Where electrical hardware is to be supplied and installed provide the Contractor with riser diagrams listing the correct wire runs and back box sizes as well as 115V AC requirements.
7. Operations and Maintenance Data
    1. Prior to Substantial Performance, provide the following information for inclusion in Operation and Maintenance Manuals:
        1. Maintenance instructions for each hardware item,
        2. Catalogue cut sheets and Product Specifications or each product,
        3. Parts list for each product,
        4. Copy of final "as-built" finish hardware schedule, and
        5. Copy of final keying schedule.
8. Maintenance Materials
    1. Provide the following maintenance materials:
        1. Five (5) of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

1.8 DELIVERY, STORAGE, AND HANDLING

1. Deliver each hardware item in its original package complete with all fasteners, keys, templates, and installation instructions required for installation.
2. Package hardware separately for each door or unit and state clearly on each package the number and description of the door or unit for which the hardware therein is intended. Group items accordingly.

3. Clearly mark each container with the door opening number and the hardware schedule item or heading number.
4. Store hardware in a locked room or other secure area, accessible by only the Contractor. Storage area must contain adequate storage provision to hold all hardware off the floor (temporary shelving or wood pallets). Ensure area is kept dry and clean.
5. When requested, package items of hardware separately for delivery to other fabricators for their installation.
6. Deliver and assist in unloading and sorting of hardware. All hardware must be checked in on site by the Contractor's Site Supervisor.

1.9 COORDINATION WITH OTHER TRADES

1. Supply finish hardware to those who are to install it, complete with templates and other complete installation instructions in sufficient time to avoid delaying the progress of the work.
2. Supply complete templates and instructions to all door and frame manufacturers for factory machining of products to receive Hardware.

1.10 INSPECTION

1. Hardware Distributor must perform the following inspections:
    1. Check all hardware when it has been installed and notify the Consultant of improper installation, defective materials, or products installed that were not specified. Replace defective hardware promptly.
    2. Check all door closers after they have been installed to make sure that all adjustments such as back-checking degree have been properly made. Notify the Consultant of any closers which have not been properly adjusted.

1.11 MAINTENANCE

1. Maintenance Service
    1. Following occupancy of the building by the Owner, arrange with the Owner's maintenance staff for instruction of proper use, servicing, adjusting and lubrication of all finish hardware. Submit to the Consultant a list of attendees and meeting date.

1.12 EXTENDED WARRANTIES

1. Provide the following manufacturer's warranties beyond the date of expiration of the Contract warranty:
    1. Hinges - Lifetime
    2. Electrified Hinges – One (1) year
    3. Mortise locksets - Seven (7) years
    4. Electrified Locksets – Two (2) years
    5. Exit Devices - Five (5) years
    6. Door closers - Ten (10) years
    7. Electric Strikes – Five (5) years

2 Products

2.1 ACCEPTABLE MANUFACTURERS

1. Subject to conformance to requirements provide hardware manufactured by the following:
    1. Dorma Group of Companies.
    2. ASSA-ABLOY Group of Companies.
    3. Allegion Group of companies.

2.2 MATERIALS

1. Fabricate all hardware to template. Provide templates and template hardware together with the instructions necessary for door and frame preparation.
2. Supply all hardware with necessary screws, bolts or other fastening devices to anchor hardware in position neatly and properly in accordance with best practices.
3. Only products listed in the hardware schedule or the approved alternates noted in the following list are to be used on this project.
4. Use one manufacturer's products only for all similar items.
5. All exterior doors shall be fitted with complete perimeter weatherstripping and threshold where not provided by door or frame manufacturer.
6. No substitutions are allowed for the following products, due to integration with existing hardware:
    1. Locksets, Latchsets, and Privacy Sets.
    2. Panic Sets
    3. Door Closers.

2.3 FASTENINGS

1. Supply all required bolts, screws, expansion shields, anchors, and other related accessories for satisfactory attaching or installing of all finish hardware.
2. Exposed fasteners shall match finish of, and be of compatible material with hardware.
3. Where push/pull hardware is scheduled, door pull must be through-fastened and have fasteners concealed by push plate on opposite side.

2.4 HINGES

1. Butt Hinges: ANSI/BHMA-A156.1, Grade 1.
    1. Supply hinges with non-removable pin (NRP) option on all doors where the hinge barrel is exposed on the secured exterior side of the door.
    2. Use two hinges on doors up to 1525mm and an additional hinge for each additional 760mm or fraction thereof.
    3. Doors 914mm wide and less: 114mm high hinges; doors greater than 914mm to 1220 mm wide: 127mm high hinges; all standard weight.
    4. Supply standard weight and heavy weight concealed bearing hinges on all doors equipped with door closers; ferrous (steel) material for all interior and/or fire-rated doors and stainless steel for exterior doors as listed in the hardware groups.

2.5 SURFACE/FLUSH BOLTS

1. Surface/Flush Bolts: ANSI/BHMA-A156.16, Grade 1.
    1. Surface Bolts
        1. Surface bolts to have 25mm throw with vandal-resistant concealed mounting. Units to be constructed of heavy duty steel and be ULC listed up to three (3) hours when used on the inactive door of a pair up to 2440mm in height.
    2. Manual Flush Bolts-Metal Doors
        1. Manual flush bolt for metal doors to be ULC listed for 3-hour fire doors with 13mm diameter bolt tip, 19mm throw. Rod length to be 305mm. Supply dustproof strikes with all flush bolts.
    3. Manual Flush Bolt-Wood Doors

1. Manual flush bolt for wood doors to be ULC listed for 90min fire doors with 19mm throw with a 22mm vertical adjustment. Supply dustproof strikes with all flush bolts.

4. Automatic Flush Bolts-Metal Doors

    1. Automatic flush bolts for metal doors, fully automatic, ULC listed for 3 hour fire doors, low actuation forces, top bolt has spring tension, non-handed with 19mm throw with a 22mm vertical adjustment. Optional rod length for non-rated openings. Auxiliary fire latch that eliminates the bottom bolt for ULC listed doors. Supply dustproof strikes with all flush bolts.

5. Automatic Flush Bolts- Wood Doors

    1. Automatic flush bolts for wood doors to be fully automatic ULC listed for 90min fire doors, low actuation forces, top bolt has spring tension, non-handed with 19mm throw with a 22mm vertical adjustment. Auxiliary fire latch that eliminates the bottom bolt for ULC listed doors (20min only). Supply dustproof strikes with all flush bolts.

2.6 LOCKSETS, LATCHSETS, DEADLOCKS

1. Grade 1 Deadbolt

    1. ANSI/BHMA-A156.5, Grade 1 deadbolt supplied with solid brass or bronze trim rings and 25mm throw high-strength, steel alloy deadbolt with hardened steel roller resistant to sawing and kick-in attacks. Metal shield protects bolt from attack through the door as well as hardened steel balls that protect mounting screws from drill attack. Exclusive wood frame reinforcer protects wood jamb against kick-in attacks.

2. Grade 1 Cylindrical

    1. ANSI/BHMA-A156.2, Grade 1 extra heavy duty residential, commercial, institutional and industrial applications. Latch bolts to be steel with minimum 13mm throw deadlocking on keyed and exterior functions. 19mm throw anti-friction latchbolt on pairs of fire doors. Provide manufacturer's standard wrought box strike for each latch or lock, with curved lip extended to protect frame. Lock case to be steel. Locks to incorporate one piece spring cage and spindle. Precision solid brass 6-pin cylinder with nickel silver keys. All levers to be solid with no plastic inserts. Locks and latchsets tested to exceed 3,000,000 cycles.

3. Grade 1 Mortise

    1. ANSI/BHMA-A156.13, Grade 1 Operational, Grade 1 Security, mortise lock for commercial and institutional buildings. Lock cases to have a high strength steel alloy cylinder retainer with a captured ¼-20 set screw. Lock case to be field reversible without chassis disassembly. Supply locksets with lock cases manufactured from 2.7mm steel with internal components of steel with zinc-dichromate plating for corrosion resistance. Case cover to be secured with four screws for increased rigidity. Locks are to feature a full 19mm throw two-piece stainless steel mechanical anti-friction latchbolt with 25mm throw deadbolt constructed of sintered stainless steel. Deadbolt to remain a minimum of 16mm within lock case when fully extended. All mortise locks are to feature external spring cages. Stop works functions to be by turn unit. Lock cases with stop works on edge of lock case will not be accepted. Spindles to be such that if forced it will twist first, then break (approx. 81.3 N/m of torque).

4. All Grade 1 and Grade 2 cylindrical lever locksets shall have a free wheeling or clutch mechanism so the lever moves when in the locked position without retracting the latch bolt.

2.7 EXIT DEVICES

1. Narrow Style: ANSI/BHMA-A156.3, Grade 1 ULC listed for panic hardware and fire exit hardware. Supply exit devices with smooth mechanism case and “the quiet one” fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Fits door stiles as narrow as 45mm.
2. Heavy Duty: ANSI/BHMA-A156.3, Grade 1 ULC listed for panic hardware and fire exit hardware. Supply exit devices and fire exit devices featuring coil compression springs on all device mechanism subassemblies and dead latching mechanisms for all active latchbolts. Supply exit devices with smooth mechanism case and “the quiet one” fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Roller strikes to be standard on all rim and surface vertical rod devices. Doors greater than 914mm wide supply long bar exit devices, doors 2134mm high and greater supply extension rods. 1,000,000 cycle testing independently certified by ETL.
3. Device Trim
    1. Supply device trim featuring recessed cylinder mounting and coil compression spring design with shear pin protection for all lever designs. Similar lever designs for exits as specified for locksets.
4. Mullions Non-Rated
    1. Aluminum mullions complete with mullion stabilizers prepared with strikes for use with all rim devices to provide single door performance and security on double door applications.
    2. Steel mullion prepared for two strikes for use with all rim devices and key removable kit to provide quick removal to provide single door performance and security on double door applications.
5. Mullions Rated
    1. Fire rated ULC approved mullion for up to three hour openings up to 2.4m x 2.4m using rim devices prepared for strikes. Supply with key removable kit to provide quick removal to provide single door performance and security on double door applications.
6. Exit devices installed on exterior doors must have dead latching bolts to ensure tamper proof security.

2.8 DOOR CLOSERS

1. Door closers to be Grade 1 ANSI/BMHA A156.4, and have the following features (see separate closer sections below for further information):
    1. Fully hydraulic, rack and pinion action with high strength cast iron cylinders and one piece forged steel pistons.
    2. Hydraulic fluid of a type requires no seasonal adjustments, and has constant temperature control from 49^{o}C to –35^{o}C.
    3. Hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.
    4. Separate adjustments for backcheck, general speed and latch speed.
    5. Include high efficiency, low friction pinion bearings.
    6. Size 1 manual door closers to provide less than 22N opening force on a 914mm door leaf.
    7. Closers with painted finishes shall exceed a minimum 100-hour salt spray test, as described in ANSI/BHMA-A156 and ASTM B117.

8. Closers detailed with plated finishes shall include plated covers (or finish plates), arms and visible fasteners.
9. Provided with all mounting plates required to mount on any special door and frame conditions.

2. Medium Duty Mechanical (Interior/Exterior)

    1. ANSI/BHMA-A156.4, non-sized (1-6) and non-handed cylinder body to have 32mm piston diameter with 16mm single heat-treated shaft. Track closer cylinder body non-sized (2-4) or (1-2). Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

3. Medium Duty Mechanical (Interior)

    1. ANSI/BHMA-A156.4, non-sized (1-4) and non-handed cylinder body. Track closer cylinder body non-sized (1-3). Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck. Closer to have standard metal cover not to exceed 45mm from face of the door.

4. Heavy Duty Mechanical (Pull Side Mount)

    1. ANSI/BHMA-A156.4, non-sized (1-5) and handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory. Track closers sized 1, 3 or 4. Closers to have forged steel main arm. Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

5. Heavy Duty Mechanical (Top Jamb Mount)

    1. ANSI/BHMA-A156.4, non-sized (1-5) and handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory. Track closers sized 1, 3 or 4. Closers to have forged steel main arm. Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

6. Medium Duty Mechanical (Interior-Pull Side Mount)

    1. ANSI/BHMA-A156.4, sized (1, 2, 3 or 4) and handed cylinder body to have 32mm piston diameter with 16mm single heat-treated shaft. Closers to have forged steel main arms. Optional arms to be interchangeable within the series of closers. Standard plastic cover not to exceed 41mm from face of door.

7. Heavy Duty Mechanical (Multiple Applications)

    1. ANSI/BHMA-A156.4, non-sized (1-6) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory with power-adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

8. Heavy Duty Mechanical (Parallel Arm Mount)

    1. ANSI/BHMA-A156.4, non-sized (1-5) and handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory. Track closers sized 1, 3, or 4. Closers to have forged steel main arm and forearms. Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

9. Medium Duty Mechanical (Interior-Push Side Mount)

    1. ANSI/BHMA-A156.4, sized (1, 2, 3 or 4) and handed cylinder body to have 32mm piston diameter with 16mm single heat-treated shaft. Closers to have forged steel main arm and forearms. Optional arms to be interchangeable within the series of closers. Standard plastic cover not to exceed 41mm from face of door.

10. Heavy Duty Single Point Hold-Open (Pull and Push Side Mount):

    1. ANSI/BHMA-A156.4, non-sized (1-4) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft with adjustable single-point hold open function controlled by solenoid assembly located in a head frame mounted track. Track arm to have single lever arm with low friction track and roller assembly. Unit to have a momentary on/off switch board assembly for testing door release and also provides over-voltage protection.

11. Heavy Duty Multi-Point Hold-Open (Pull Side Mount):

    1. ANSI/BHMA-A156.4. Provide closer/holder designed to hold open the door in the open position under normal usage and to release and automatically close the door under fire conditions. Closer will include an integral Electro-magnetic holder mechanism designed for use with ULC listed fire detectors, provided with normally closed switches. Sized (3 or 4) and handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft with multi-point hold open function controlled by solenoid in the cylinder assembly. Track arm to have single lever arm with low friction track and roller assembly with swing free function with no-drift feature. Unit to have a momentary on/off switch board assembly for testing door release and also provides over-voltage protection. Where detailed multi-point closer/holders shall incorporate a hold open bypass feature from 0 degrees up to either 80 degrees or 140 degrees.

12. Heavy Duty Multi-Point (Push Side Mount):
    1. ANSI/BHMA-A156.4. Provide closer/holder designed to hold open the door in the open position under normal usage and to release and automatically close the door under fire conditions. Closer will include an integral Electro-magnetic holder mechanism designed for use with ULC listed fire detectors, provided with normally closed switches. Sized (3 or 4) and handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft with multi-point hold open function controlled by solenoid in the cylinder assembly. Unit to be supplied with forged steel main arm. Unit to have a momentary on/off switch board assembly for testing door release and also provides over-voltage protection. Where detailed multi-point closer/holders shall incorporate a hold open bypass feature from 0 degrees up to either 80 degrees or 140 degrees.

2.9 DOOR OPERATORS

1. Heavy Duty Electric Operator (Push Side Mount)
    1. ANSI/BHMA-A156.19, non-sized (2-5) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft. With forged steel main arm. Power operator to include:
        1. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.
        2. Second Chance Function: program within the on-board computer monitoring resistance during opening cycle. If resistance is present operator pauses for a few seconds, then attempts to open door again. If resistance does not exist door will open normally. However, if resistance still exists, door will pause and the unit will time out and door will close.
        3. Breakaway Drive System: System within the motor/clutch assembly. If the door is forced closed while in the opening cycle, the clutch slips preventing damage to the operator, door and frame.
        4. Soft Start Motor Control: required for controlled start once actuator is depressed to extend the service life of all drives components.
        5. Built in Power Supply to deliver 12V and 24V outputs up to a maximum of 1.0 amp.
        6. Certified by ULC for use on labeled doors.
        7. Independent adjustments for all electrically controlled functions within controller module.
2. Actuators
    1. Wall Type
        1. Wall plate switch to be hard-wired either 12V DC or 24V DC actuator with round, stainless steel touch plate in either 114mm or 152mm diameters. Engraved blue filled handicap symbol conforms to most accessibility codes. Units to include heavy grade components for vandal resistant mounting and weather resistant switch standard.
3. Low energy door operators will be supplied and installed by factory trained installers. Hardware supplier will coordinate the installation of the door operators and include the cost of labour for this work.

2.10 PULLS AND PLATES

1. Supply door trim as listed in hardware schedule. Supply pulls with back to back (BTB) or through bolt mounting as required. When push plates are listed with door pulls, install the push plate to conceal the through bolt.

2. All kickplates, push plates, and bumper plates must have all sides beveled and corners rounded to ensure no sharp edges. Supply plates with counter sunk screw holes. Supply double-sided tape for adhesive-mount.
3. Kick plates will be minimum 0.127mm thick unless listed otherwise; size to be door width less 35mm for single door, and less 25mm for pairs of doors. Heights as scheduled.

2.11 DOOR STOPS AND HOLDERS

1. Floor Stops (Doors without Threshold)
    1. ANSI/BHMA-A156.6. Floor stops to be 25mm overall height with 4.8mm base height for use on doors without thresholds. Heavy-duty cast dome stop constructed of brass/bronze with gray, non-marring rubber bumper.
2. Floor Stops (Doors with threshold or undercut doors)
    1. ANSI/BHMA-A156.6. Floor stops to be 25mm overall height with 14.3mm base height for use on doors with thresholds or undercut doors. Heavy-duty cast dome stop constructed of brass/bronze with gray, non-marring rubber bumper.
3. Wall Stops (No Button on Locking Hardware)
    1. ANSI/BHMA-A156.6. Wall stops to be constructed of heavy-duty brass base with special retainer cup that makes the rubber stop tamper resistant. Convex design of rubber bumper.
4. Wall Stops (Projecting Button on Locking Hardware)
    1. ANSI/BHMA-A156.6. Wall stops to be constructed of heavy-duty brass base with special retainer cup that makes the rubber stop tamper resistant. Concave rubber bumper to avoid damage to locks with projecting buttons.
5. Supply wall stops where wall conditions are sufficient to support impact loads, such as stud partitions with wood blocking, masonry, or concrete. Supply floor stops with sufficient height to suite the floor condition or undercut of doors.
6. Overhead stops and mechanical holders shall be surface mounted unless a conflict exists with door closers or other hardware. Provide door stays with friction action in locations that do not have door closers. Install all overhead stops and holders for 90° stop unless otherwise specified.
7. Electronic door holders will be supplied tri-voltage and be connected to the fire alarm system by Division 26 to release the door when signaled.

2.12 DOOR SEALS

1. Supply perimeter seals to fully cover all gaps between door, frame, and floor condition to seal against weather, sound, or smoke as required and scheduled.
2. Frame gaskets shall be closed cell neoprene. Extruded housing must have a rib to prevent distortion during installation. Aluminum frames will be provided with weather stripping inserts by the frame supplier.
3. Door bottoms will be heavy-duty and have an adjustment screw to ensure proper contact with flooring. Supply correct drop insert for carpet where required.

2.13 THRESHOLDS

1. Supply extruded aluminum thresholds to ensure the sweep or door bottom makes full contact. Supply thermally broken thresholds for all exterior door openings.
2. Threshold height shall not exceed 13mm for barrier-free path of travel.

2.14 EMERGENCY CALL SYSTEM

1. Provide emergency call system in universal washrooms in accordance with applicable code requirements and authority having jurisdiction.
2. Emergency button: Consisting of audio and visual signal devices activated inside washroom.
3. Provide sign reading “IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE” in letters at least 25 mm high with a 5 mm stroke and that is posted above the emergency button.
4. Coordinate electrical power supply with division 26.

2.15 ELECTRONIC HARDWARE

1. Keyswitch
    1. Keyswitch housing to be cast zinc to protect against vandalism, housing to provide a concealed rear mounting attachment which cannot be compromised when the cylinder is attached with a set screw. Standard stainless steel cover plate.
2. Electric Strikes
    1. ANSI/BHMA-A156.31, Grade 1. Electric strikes to be ULC listed burglary-resistant and electric strike for fire doors and frames; "A" label for single doors and "B" label for double doors. Electric strikes to be stainless steel construction, non-handed available in 12V or 24V AC or DC with continuous duty solenoid and accept 19mm throw latchbolts. Strike box to be adjustable to compensate for any misalignment of the door or frame with two piece plug connector for ease of installation.
3. Magnetic Locks
    1. ANSI/BHMA-A156.23, Grade 1. Electromagnetic locks to be field selectable dual voltage 12/24VDC with a minimum holding force of 7,339N, residual magnetism within one second of 17.8N maximum and inductive kickback not to exceed 53 volts peak. Electromagnetic locks to be powered by filtered and regulated power supply. Electromagnetic locks used on labeled fire door assemblies shall be ULC listed as auxiliary locks, rated for A-label openings. Housings shall not project more than 45mm into the door opening. Electromagnetic locks to be furnished with an adjustable mounting bracket for accurate installation and furnished with an integral circuit board with terminal strip for accurate wiring.
4. Power Supplies
    1. Power supplies to be Underwriter Laboratories (UL) listed for general-purpose use tested to meet UL1012 specifications. Power supplies to have 12/24V DC field selectable output voltage with output current of 3 amps at 12V DC and 2 amps at 24V DC with supply output voltage filtered and regulated. The power supply to be inherently modular by design for ease of installation and to provide flexibility for future system modifications when necessary.
5. Include power supplies that are compatible with magnetic lock and have a NFPA-101 fire alarm release. Reset key switch will be centrally located and will re-arm all the magnetic locks in the building.
6. Access control will be frame-mounted stand-alone keypad complete with adjustable time delay. Units will have all functions keypad programmable, 12 or 24 volt AC/DC with a code length of 3-6 digits.
7. Electronic hardware will be supplied and installed by this section, including all low voltage device wiring.

2.16 FINISHES

1. Finishes are specified as follows:
    1. As indicated on Finish hardware schedule.

2.17 KEYING

1. General
    1. Architectural Hardware Consultant (AHC) will meet with the Owner to obtain and finalize all keying requirements, and will subsequently issue copies of the keying schedule for review.
    2. Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Owner prior to occupancy. The Owner or Owner's Agent will void the operation of the construction keys.
    3. Key Material: Provide manufacturer's standard embossed keys of nickel silver to ensure durability.
    4. Key Quantity: Furnish keys in the following quantities:
        1. Temporary construction keys: 10 each.
        2. Grand Master keys per grand master group: 6 each.
        3. Master keys per master group: 6 each.
        4. Change keys per cylinder or keyed alike group: 4 each.
        5. 5 Extractor tools each.
    5. Deliver all permanent key blanks and security keys direct to Owner from factory by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.
    6. Furnish one key control system complete with indexed door numbers, key codes, bittings, building numbers, room numbers, lock function, design, and finish. In addition, include model numbers, handing, design, and functions of exit devices and door closers. Transmit to the Owner by secure carrier, return receipt requested.
    7. Provide complete cross-index system, place keys on markers and hooks in the cabinet as determined by the finial key schedule. Provide one each key cabinet and hinged panel type cabinet for wall mounting as noted in detailed hardware schedule.
2. Standard Keying With Exterior High-Security Cylinders
    1. Interior locks and cylinders shall be furnished in a new masterkey system.
    2. Exterior locks and cylinders to be high-security removable core cylinders with level-three side-bit milling to allow integration with existing standard key systems.
    3. Permanent cylinders to be factory-keyed, combined in sets or subsets, master keyed or great grand master keyed, as directed by Owner. Permanent keys and cylinders shall be marked with the keyset symbol on all key blanks for identification. Visual key control marks or codes will not include the actual key cuts.

3 Execution

3.1 EXAMINATION

1. Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.
2. Ensure that door frames and finished floor are sufficiently plumb and level to permit proper engagement and operation of hardware.
3. Submit to Consultant in writing a list of deficiencies determined as part of inspection required in 3.3.1 and 3.3.2, prior to installation of finished hardware.

3.2 INSTALLATION

1. Install hardware to ANSI/DHI-A115.1G.
2. Install hardware at mounting heights as specified in the manufacturer's templates or specific references in approved hardware schedule or approved elevation drawings. Where mounting height is not otherwise specified herein, install hardware at the following mounting heights:
    1. Locksets: 1015mm.
    2. Exit device: 1015mm.
    3. Push/Pull: 1065mm.
    4. Deadlock: 1200mm.
3. Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.
4. Ensure that all locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. Handing is part of installation procedure.
5. Ensure that all exit devices are of the correct hand and adjust device cam for proper outside trim function prior to installation. Handing is part of installation procedure.
6. Follow all manufactures installation instructions. Adjustment is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.
7. Delayed action door closers are to be adjusted to forty (40) second delay for handicapped accessibility and movement of materials. Time period to be approved by Owner.
8. Install head seal prior to installation of parallel arm mounted door closers and push side mounted door stops/holders.
9. Counter sink through bolt of door pull under push plate during installation.
10. Mount all closers, automatic operators and hold-open devices with through bolts, as indicated in the finish hardware schedule.
11. Where door stop contacts door pulls, mount stop to strike bottom of pull.
12. Remove construction locks when directed by Consultant; install permanent cores and check operation of all locks.
13. Other trades installing hardware must follow all manufacturer's instructions including door closer adjustment, handing of locksets as required, and degree of door swing.
14. Hardware Distributor will include all labour to terminate secondary low voltage wire runs at all door control devices supplied by this section, including but not limited to; door operators, magnetic locks, push button code entry units (keypads), request to exit switches, electric strikes and any associated electrical equipment. Ensure system is tested and complete for Owner's use. Provide staff training for push button code system (keypads) including all programming function and maintenance.
15. Hardware Distributor will instruct the installer as to how various newer or unusual items that are required to be installed for proper performance.

3.3 FIELD QUALITY CONTROL

1. Hardware distributer to perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.
2. Upon completion of hardware installation, arrange with the Owner and Consultant demonstration and training in the proper operation, adjustment, and maintenance of all finish hardware supplied under this Contract.

3. Before completion of the Work but after finish hardware installation has been completed, submit a certificate to the Consultant stating that final inspection has been made and that all hardware has been checked for installation and operation by representatives of both the Hardware Supplier and the Hardware Distributor, and that operation and maintenance of all hardware has been fully demonstrated to the satisfaction of the Owner, and verified by Consultant.

3.4 ADJUSTING AND CLEANING

1. Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.
2. All hardware to be left clean and free of disfigurements.
3. Check all locked doors against approved keying schedule.

3.5 PROTECTION

1. Protect hardware from damage during construction period by removing and reinstalling or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturer’s warranty.

3.6 HARDWARE SCHEDULE

1. Refer to Hardware Groups listed in the schedule follow by this Section.

END OF SECTION

Hardware Group 1:
Door No.: D1-1

Qty.	Description		Catalogue Number	Finish	Manufacturer
2	Continuous Hinge (power transfer)	✓	651HD x EPT	32D	BE
1	Exit Device	✓	9875 x QEL x LNL x Rhodes	630	VON
1	Exit Device	✓	9849 EO x QEL	630	VON
1	Permanent Core		To Owner System		
1	Auto Door Operator	✓	9550 (120/240 VAC)	628	LCN
2	Actuator Touch	✓	8310-852	630	LCN
2	Door Sweep		8198AA x Door Width	AA	ZER
1	Weatherstripping (Jamb)		328AA x Opening Height	AA	ZER
1	Weatherstripping (Head)		429AA x Opening Width	AA	ZER
1	Astragal		383AA x Door Height	AA	ZER
2	Kickplate		8400 x 205mm x 25mm x Less Door Width	630	IVE
1	Threshold		8726A-223 x Opening Width	A	ZER
1	Card Reader	✓	By Security Consultant		BY
2	Door Position Sensor	✓	By Security Consultant		BY
1	Request to Exit	✓	By Security Consultant		BY
1	Keypad	✓	By Security Consultant		BY
1	Motion Detection Sensor	✓	By Security Consultant		BY

Hardware Group 2:
Door No.: D1-2, D12-1, D12-2, D13-1, D13-2, D14-1, D14-2, D15-1, D15-2

Qty.	Description		Catalogue Number	Finish	Manufacturer
1	Continuous Hinge (power transfer)	✓	780-112HD x Door Height x ETW	628	IVE
1	Exit Device	✓	9875 x QEL x LNL x Rhodes	630	VON
1	Permanent Core		To Owner System		
1	Door Closer		4040XP x REG or PA as requested	689	LCN
1	Overhead Stop		100S	630	GLY
1	Door Sweep		8198AA x Door Width	AA	ZER
1	Weatherstripping (Jamb)		328AA x Opening Height	AA	ZER
1	Weatherstripping (Head)		429AA x Opening Width	AA	ZER
1	Kickplate		8400 x 205mm x 25mm x Less Door Width	630	IVE
1	Threshold		8726A-223 x Opening Width	A	ZER
1	Card Reader	✓	By Security Consultant		BY
1	Door Position Sensor	✓	By Security Consultant		BY
1	Request to Exit	✓	By Security Consultant		BY

Hardware Group 3:
Door No.: D8

Qty.	Description		Catalogue Number	Finish	Manufacturer
3	Butt Hinges		5BB1HW x 114 x 102	630	IVE
1	Storeroom Lockset		L9080 x HD x 06B	630	SCH
1	Permanent Core		To Owner System		
1	Electric Strike		6211 FSE CON	630	VON
1	Auto Door Operator	✓	9540 (120/240 VAC)	628	LCN
2	Actuator Touch	✓	8310-852	630	LCN
1	Kickplate		8400 x 205mm x 25mm x Less Door Width	630	IVE
1	Floor Stop		FS13	606	IVE
1	Wire Harness	✓	CON-6W		SCH
1	Push to Lock Button	✓	CM-AF550R	630	CAM
1	LED Occupied Indicator	✓	CM-AF500		CAM
1	Washroom Relay	✓	CX-33		CAM

Hardware Group 4:
Door No.: D2, D4, D5, D6, D7, D9

Qty.	Description	Catalogue Number	Finish	Manufacturer
3	Butt Hinges	5BB1HW x 114 x 102	630	IVE
1	Storeroom Lockset	L9080 x HD x 06B	630	SCH
1	Door Closer	4040XP x REG or PA as requested	689	LCN
1	Floor Stop	FS13	606	IVE
1	Kickplate	8400 x 205mm x 25mm x Less Door Width	630	IVE

Hardware Group 5:
Door No.: D3

Qty.	Description		Catalogue Number	Finish	Manufacturer
3	Butt Hinges		5BB1HW x 114 x 102	630	IVE
1	Storeroom Lockset		L9080 x HD x 06B	630	SCH
1	Door Closer		4040XP x REG or PA as requested	689	LCN
1	Floor Stop		FS13	606	IVE
1	Kickplate		8400 x 205mm x 25mm x Less Door Width	630	IVE
1	Electric Strike		6211 FSE CON	630	VON
1	Card Reader	✓	By Security Consultant		BY
2	Door Position Sensor	✓	By Security Consultant		BY
1	Request to Exit	✓	By Security Consultant		BY

Hardware Group 6:
Door No.: D10, D11-1, D11-2

Qty.	Description	Catalogue Number	Finish	Manufacturer
3	Butt Hinges	5BB1HW x 127 x 114	630	IVE
1	Storeroom Lockset	L9080 x HD x 06B	630	SCH
1	Door Closer	4040XP x REG or PA as requested	689	LCN
1	Overhead Stop	100S	630	GLY
1	Kickplate	8400 x 205mm x 25mm x Less Door Width	630	IVE

Hardware Group 7:
Door No.: D12-3, D12-4, D13-3, D13-4, D14-3, D14-4, D15-3, D15-4

Qty.	Description	Catalogue Number	Finish	Manufacturer
1	Weatherstripping	On both sides of door height		By Door Mfg.
1	Door Sweep	Door Width		By Door Mfg.
1	Overhead Door Contact	By Security Consultant		BY

END OF SCHEDULE

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Section includes supply and installation of glass and glazing for sections referencing this section for products and installation of:

.1 Glazing materials.

.2 Sealed insulating glass units (IGU).

.3 Glass films (FILM).

1.3 PERFORMANCE REQUIREMENTS

.1 Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with the Building Code and to withstand design pressures specified in applicable sections.

.2 Where glass extends from 1070 mm to floor, design lateral loads, in addition to other load requirements, in accordance with applicable codes.

.3 Unless otherwise specified, limit glass deflection to L/175 or flexure limit of glass with full recovery of glazing materials, whichever is less.

.4 Provide tempered, laminated, laminated-heat strengthened and heat soaked glass and related fittings and hardware in doors, side lites, screens, storefronts, glazed curtain walls, and glazed guard rails accordance with applicable codes and as indicated or scheduled.

.5 Unless otherwise specified or indicated, provide tempered glass where sill of glass is less than 300 mm above finished floor.

.6 Unless otherwise specified or indicated, provide laminated-heat strengthened and heat soaked glass where glass is a guard.

.7 Sealed Insulating Glass Units: Provide units free of the following characteristics:

.1 Appearance of condensation between panes.

.2 Obstruction of vision at unit perimeter.

.3 More than 10 percent measurable deterioration of thermal transmission or shading coefficient values.

.4 Chipping, cracking, or breakage of glass panes occurring due to manufacturing defects or under specified service conditions.

.5 Migration of edge spacer.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this Section.

.2 Coordinate electrical requirement and connection with Division 26.

.3 Coordinate adequate supports in hollow partitions for large mirrors with Installers of applicable Sections.

.4 Coordination of the Location of Tempering and Laminated Glass Stamps/Logos: Contractor is required to discuss and coordinate the location of the Tempering and Laminating stamps/ logos with the Consultant at the time of shop drawing submission. This is to be reviewed and approved prior to the ordering of any glass.

1.5 SUBMITTALS FOR REIVEW

.1 Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

.2 Product Data on Glazing Sealant: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colours.

.3 Shop Drawings: For glass indicated to comply with performance requirements.

.1 Clearly indicate glass types, configurations, thicknesses, translucent finishes, treatments, coatings, gaskets, hardware and accessories.

.2 Indicate forces applied to connections at structure and analysis data.

.3 Apply signature and seal by a qualified professional structural engineer licensed in the Province where the Project is located.

.4 Samples:

.1 Submit two 300 x 300 mm samples for each type of glass specified.

.2 Samples for Colour Selection:

.1 Allow for a minimum of three iterations of samples for each type of custom coloured glass to the approval of Consultant.

.3 Samples for Verification: Submit one sample 300 x 300 mm in size, exampling each type of glass following Consultant review.

.4 Glazing Accessory Samples: Submit samples of each type of glazing accessory. For structural glazing sealants, install 300 mm length of sealant between two edges of representative glass samples.

.5 Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated or scheduled.

1.6 SUBMITTALS FOR INFORMATION

.1 Manufacturer's Certificate: Certify that glass products conform to requirements.

.2 Qualifications Data: For installer. Include proof of adequate facilities and capacity to produce work.

.3 Professional Structural Engineer’s Letters of Assurance:

.1 Provide letters or completed prescribed forms, signed by the professional structural engineer used to perform inspections and design glass, stating that the glass indicated conforms to performance requirements and design criteria, and has been fabricated and installed in accordance with applicable code requirements.

1.7 QUALITY ASSURANCE

.1 Perform Work in accordance with GANA (Glass Association of North America) Glazing Manual, and GANA Laminated Glazing Reference Manual, for design and fabrication of glazing and installation methods.

.2 Perform Work in accordance with Insulating Glass Manufacturer's Association of Canada (IGMAC) Glazing Guidelines for Sealed Insulating Glass Units, including requirements for guaranteed service life for manufacture and installation of sealed insulating glass units.

.3 Certify units to Insulating Glass Manufacturers Alliance (IGMA) program to ASTM E2190.

.4 Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: An insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

.5 Installer Qualifications: Company specializing in performing the work of this Section with minimum five (5) years' continuous documented experience on projects of similar scope and size, approved by the manufacturer, and a member in good standing of the OGMA.

.6 Labelling:

.1 Label glass, including mirrors, with manufacturer's labels identifying glass type and thickness.

.2 Safety Glazing: Permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and the safety glazing standard with which glass complies.

.3 Insulating Glass Units: Permanently mark spacers, or at least one component lite, of units with appropriate certification label of IGMAC.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

.2 Minimize storage time of materials at site.

.3 Minimize handling. Install glass as soon as possible after delivery.

.4 Store glass at a constant temperature, vertically, blocked off the floor and in a designated clean, dry and dust-free and corrosive contaminant-free interior storage area with adequate air circulation.

.5 Protect glass from contact with contaminants.

1.9 WARRANTY

.1 Provide a ten (10) year manufacturer's insulated glass unit warranty to include coverage for:

.1 Sealed glass units from seal failure, interpane dusting or misting of any nature, and replacement of same.

.2 Delamination of laminated glass and replacement of same.

.3 Colour fading of interlayer and replacement of whole glass units.

.4 Reflective coating on mirrors and replacement of same.

.2 Installation of plastic films on glass shall not diminish coverage of warranties for glass.

2 Products

2.1 MATERIALS – GENERAL

.1 Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lutes in thicknesses and heat treatment as needed to conform to requirements specified.

.1 Minimum Glass Thickness for Exterior Lites: As indicated by Design.

.2 Minimum Glass Thickness for Interior Lites: 6 mm.

2.2 GLASS MATERIALS

.1 Tempered Glass: CAN/CGSB 12.1, Type 2- Fully Tempered, Class B or ASTM C1048; Type I; Quality-Q3; Kind FT (fully tempered); Class I (clear) unless otherwise indicated; of condition indicated.

.1 Heat soak tempered float glass to BS EN 14179-1 for exterior insulated glass units.

.2 Bird Friendly glass:

.1 Ceramic Firt Coated Glass: Silk-screen process pattern of white 3 mm (1/8") diameter dots with 6 mm (1/4") staggered space between dots. Coverage 100% of glass no. 1 surface.

.3 Low-Emissivity (Low E) Coating: High performance sputtered low-E coating resulting in a stable, uniform, nearly invisible coating:

.1 Solarban 60 by Vitro Architectural Glass.

.2 SunGuard SN68 by Guardian Glass.

.4 Back Painted Glass Coating: CAN/CGSB 12.9 spandrel glass, water based silicone, minimum 0.33 mm thick, Opaci-Coat 300 by Industrial Control Development Inc., colour Primary White.

2.3 GLAZING ACCESSORIES

.1 Setting Blocks: Neoprene, EPDM or silicone, 80 to 90 Shore A durometer hardness tested to ASTM D2240, length of 25 mm for each square metre of glazing or minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area. Maximum compression set to ASTM D395 and ASTM C864

.2 Spacers: Neoprene EPDM or silicone, 40 to 60 Shore A durometer hardness tested to ASTM D2240, minimum 75 mm long x one half the height of the glazing stop x thickness to suit application. Quantity and location in accordance with IGMAC standards and as recommended by the frame and glass manufacturer. Provide face shims when gunable materials or non-shimmed tapes are used. Provide anti-walk edge blocks or side shims in dry glazed frames to limit glass lateral movement

.3 Glazing Tape: Preformed butyl compound, UV resistant, self-adhering, coiled on release paper, service temperature range of minus 40 to plus 50 degrees C, colour as selected by Consultant, minimum 3 mm thickness and as follows:

.1 Glass up to 2540 United Millimetres: 5 mm.

.2 Glass Units over 2540 United Millimetres: 6 mm.

.3 Double Glazed Units: 7 mm.

.4 Pre-Shimmed Glazing Tape: Pre-formed butyl tape, UV resistant, self-adhering, integral continuous serrated synthetic rubber shim and release paper, 10 to 15 Shore A durometer hardness, service temperature range of minus 54 to plus 104 degrees C, designed for 25 to 50 percent compression, colour as selected by Consultant, minimum 3 mm thick.

.5 Glazing Wedges and Splines: Precision extruded neoprene or EPDM compound, UV resistant, 55 to 65 Shore A durometer hardness, designed for use with pre-shimmed glazing tape, sized to suit glazing channel retaining slot.

.6 Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

.7 Structural Silicone Glazing Sealant: Structural sealant as specified in Section 07 92 00 – Sealants.

2.4 SEALED INSULATING GLASS UNITS

.1 Fabricate sealed glass units through the Insulating Glass Manufacturers Association of Canada Certification Program to CAN/CGSB 12.8 or ASTM E2910. Sealed units shall bear IGMAC or IGCC/IGMA Certified Products List number and be properly identified.

.2 Sealant:

.1 Primary Seal: Polyisobutylene as recommended by glazing manufacturer to meet performance criteria.

.2 Secondary Seal: two part silicone or polysulfide as recommended by glazing manufacturer to meet performance criteria.

.3 Perimeter Seal shall consist of three components; a "Warm Edge" spacer; a primary polyisobutylene seal between spacer and glass sheets, and a secondary two-part silicone or polysulfide perimeter seal.

.4 Gas fill: 90% of argon gas to manufacturer's specifications after completion of sealed unit fabrication.

.5 Insulated glass unit assemblies (IG):

.1 IG-1: Double Glass Unit

.1 Outer Glass Pane: 6 mm thick clear tempered glass, with bird friendly pattern on no. 1 surface and Low E coating on no. 2 surface.

.2 Air Space: 90% argon gas fill, with 12 mm, colour black, warm edge spacer seal.

.3 Inner Glass Pane: 6 mm thick clear tempered glass.

.2 IG-2: Triple Glass Unit

.1 Outer Glass Pane: 6 mm thick clear tempered glass, with bird friendly pattern on no. 1 surface and Low E coating on no. 2 surface.

.2 Air Space: 90% argon gas fill, with 12 mm, colour black, warm edge spacer seal.

.3 Middle Glass Pane: 6 mm thick clear tempered glass.

.4 Air Space: 90% argon gas fill, with 12 mm, colour black, warm edge spacer seal.

.5 Inner Glass Pane: 6 mm thick clear tempered glass.

.3 IG-3: Triple Glass Spandrel Unit

.1 Outer Glass Pane: 6 mm thick clear tempered glass, with back painted coating on no. 2 surface.

.2 Air Space: 90% argon gas fill, with 12 mm, colour black, warm edge spacer seal.

.3 Middle Glass Pane: 6 mm thick clear tempered glass.

.4 Air Space: 90% argon gas fill, with 12 mm, colour black, warm edge spacer seal.

.5 Inner Glass Pane: 6 mm thick clear tempered glass.

2.5 GLAZING FILMS

.1 Glazing film (FILM1): monolithic translucent film.

.1 Product: Fasara by 3M or approved equivalent.

.2 Colour, pattern and finish: Frosted transparent finish, to be later selected by Consultant from manufacturer’s standard range.

.2 Vision Strips (VS): Contrasting continuous horizontal vision strip, 50 mm width, at a height indicated on drawings. To meet Accessibility for Ontarians with Disabilities Act (AODA) requirements:

.1 Product: Fasara by 3M or approved equivalent.

.2 Colour, pattern and finish: Frosted transparent finish, pattern to be later selected by Consultant from manufacturer's standard range.

.3 Cleaners: Types recommended by glazing film manufacturer.

3 Execution

3.1 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

.1 Clean contact surfaces with solvent recommended for use by the sealant manufacturer, and wipe dry thoroughly.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 EXTERIOR GLAZING

.1 Aluminum Frames - Tape / Gaskets

.1 Cut glazing tape to length and set against permanent stops, level with sight line. Seal corners by butting tape and dabbing with sealant.

.2 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.

.3 Place setting blocks at 1/4 points, with edge block maximum 150mm from corners.

.4 Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.

.5 Install removable stops with gaskets inserted between glazing and applied stops.

.2 Wet Method -Sealant / Sealant

.1 Place setting blocks at 1/4 points and install glazing light or unit.

.2 Install removable stops with glazing centred in space by inserting spacer shims both sides at 600mm intervals, 6mm below sight line.

.3 Fill gaps between glazing and stops with sealant to depth of bite on glazing, maximum 10mm below sight line to ensure full contact with glazing and continue air and vapour seal.

.4 Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

.3 Structural Silicone Glazing

.1 Cut glazing tape to length and set against permanent stops, 6mm back from sight line. Seal corners by butting tape and dabbing with sealant.

.2 Place setting blocks at 1/4 points, with edge block maximum 150mm from corners.

.3 Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of light or glass unit.

.4 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.

.5 Install backer rod and weather seal between glass unit edges.

.6 Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.4 GLAZING FILM INSTALLATION

.1 Install film in locations and to designs indicated on the drawings.

.2 Clean glass to receive film, thoroughly and let dry.

.3 Install plastic film in accordance with film manufacturer's instructions.

.4 Remove all air bubbles, creases or visible distortion.

.5 Fit tight to glass perimeter.

3.5 CLEANING & PROTECTION

.1 During installation, remove all corrosive or foreign materials or droppings resulting from work of this trade.

.2 Perform initial cleaning operation of all glass and mirrors upon completion of installation. Do not remove labels or protective films until time of final cleaning.

.3 After initial cleaning, mark large lites with an "X" by using removable plastic tape. Do not use masking tape. Do not mark heat absorbing or reflective glass units.

.4 Provide instructions for the proper method and materials to be used in the cleaning and maintenance of finished surfaces. Remove all remaining labels and protective films at time of final cleaning.

3.6 SCHEDULES

.1 Refer to Schedule – Glazing on the Drawings for locations and extent of all glazing types specified herein.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of fixed louvers, bird screens, blank-off panels and attachment brackets as shown on drawings, as specified and as required for complete and proper installation.

.2 Fixed louvers to be furnished include the following:

.1 Storm Resistant Louver

1.3 REFERENCES

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM B209, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

.2 ASTM B211, Standard Specification for Aluminum and Aluminum Alloy Rolled or Cold Finished Bar, Rod, and Wire

.3 ASTM B221, Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.4 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.3 Canadian Standards Association (CSA):

.1 CAN/CSA-S157-05/S157.1, Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum

.2 CAN/CSA-S136, North American Specification for the Design of Cold-Formed Steel Structural Members

.4 Architectural Aluminum Manufacturers Association (AAMA):

.1 AAMA 605.2, Voluntary Specification for High Performance Organic Coatings on Aluminum Extrusions and Panels

.2 AAMA 800, Voluntary Specifications and Test Methods for Sealants

.3 AAMA 2605, Superior Performing Organic Coatings on Aluminum Extrusions and Panels

.4 AAMA TIR Metal Curtain Wall Fasteners (2000 Addendum)

.5 Air Movement and Control Association International Inc. (AMCA):

.1 AMCA Standard 500-L, Laboratory Methods of Testing Louvers for Rating

.2 AMCA Publication 501, Application Manual for Louvers

.3 AMCA Publication 511, Certified Ratings Program - Product Rating Manual for Air Control Devices

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate the Work of this Section with the installation of ductwork; Sequence work so that installation of louvers coincides with installation of HVAC materials without causing delay to the Work.

.2 Pre-Construction Conference: Arrange a site meeting attended by the Contractor, the Subcontractor, the Consultant, materials supplier(s), and other relevant personal before commencement of work for this Section.

.1 Review methods and procedures related to installation, including manufacturer's written instructions;

.2 Examine substrate conditions for compliance with manufacturers installation requirements;

.3 Review temporary protection measures required during and after installation.

1.5 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data:

.1 Air flow and water entrainment performance test results

.2 Material types and thickness

.2 Shop Drawings: Submit shop drawings showing the location, finished appearance and dimensions of each type of louver. Show all material, thicknesses, connections, fastenings, shapes and finishes.

.3 Coating Samples: Submit samples of factory applied coatings and finishes for Consultant’s initial selection.

.4 Samples: Submit for approval 305mm (12") long sample lengths of each type of louver blade and frame extrusion prior to full scale production, showing finish colour.

.2 Information Submittals:

.1 Certification: Submit product test reports based on evaluation of comprehensive tests performed by a qualified testing agency for each type of louver required for this project.

.2 Performance Requirements: Provide AMCA test data as required to confirm that the louvers have the specified air and water performance characteristics.

.3 Acoustical Performance: Where applicable, submit test reports to confirm that the louvers meet the specified STC and Noise Reduction requirements.

.4 Structural Requirements: Design all materials to withstand wind load of 20 psf (955 Pa) and snow loads as required by the applicable building code, and recommended by the louver manufacturer.

.1 Ensure louver members deflect no more than L/180 of span between supports when subjected to wind load applied horizontally to louver face.

.5 Delegated Design Submittals: Furnish complete design calculations and details, fabrication and erection shop drawings and site review for fixed louvers, bearing the seal of a Professional Engineer registered in the Province of the Work, in accordance with applicable Building Code and Contract Documents.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit manufacturer’s written instructions for cleaning solutions, materials and procedures, include name of original installer and contact information..

.1 Provide specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturer / Supplier: Obtain materials from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties.

.2 Installers: Execute Work of this Section using qualified personnel skilled in installation of work of this Section, having a minimum of three (3) years proven experience of installations similar in material, design, and extent to that indicated for this Project.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery: At the time of delivery, visually inspect all materials for damage. Note any damaged boxes, crates, or louver sections on the receiving ticket and immediately report to the shipping company and the material manufacturer.

.2 Storage: Store louver raised off the ground and cover with a weather proof flame resistant sheeting or tarpaulin.

.3 Handling:

.1 Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.

.2 Louver sections may be hoisted by attaching straps to the jambs and lifting the section while it is in a vertical position.

.3 Louver sections should only be lifted and carried by the jambs. Heads, sills and blades are not to be used for lifting or hoisting louver sections.

1.9 SITE CONDITIONS

.1 Verify dimensions of actual opening by field measurements before fabrication and indicate measurements on Shop Drawings where fixed louvers are indicated to fit walls and other construction.

.2 Establish dimensions and proceed with fabricating fixed louvers where field measurements cannot be made without delaying the work; allow for trimming and fitting.

1.10 WARRANTY

.1 Warrant the work of this section in accordance with General Conditions but for a period of one (1) year and agree to repair or replace faulty materials or work which becomes evident during the warranty period without cost to the Owner and at the Owner's convenience.

.2 Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on aluminum louvers within the specified warranty period and agreeing to repair finish or replace louvers that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, colour fade, chalking, cracking, peeling, and loss of film integrity for a period of ten (10) years from date of Substantial Performance.

2 Products

2.1 MANUFACTURER

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar fixed metal louvers may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 McGill Architectural Products

.2 TenPlus Architectural Products Ltd.

.3 Construction Specialties

2.2 MATERIALS

.1 Aluminum Extrusions: ASTM B211, Aluminum Alloy 6063-T52.

.2 Aluminum Sheet: ASTM B209, Aluminum Alloy 6063-T52.

.3 Fastenings: Provide zinc plated steel or AISI Type 304 stainless steel for screws and fasteners.

.4 Structural Support: Designed and furnished by louver manufacturer to support wind load of 955 Pa (20 psf), unless otherwise specified.

2.3 FIXED LOUVER SYSTEMS

.1 Storm Resistant Louvers:

.1 178mm (7") deep fixed type, storm resistant aluminum louver, with 6063-T52 aluminum alloy extrusion, and as described in the following performance criteria:

.1 Certification: Louver AMCA tested, certified and licensed to bear the AMCA seal for the following:

.1 Air performance

.2 Water penetration

.3 Wind driven rain

.2 Extrusion Thickness:

.1 Head, Sill, Jambs and Mullions: Minimum 2mm (0.080") thick.

.2 Blades: Minimum 2mm (0.080") thick.

.3 Louver Type: Mullion or continuous line construction

.4 Blade Angle: 35º

.5 Free Area - 1220mm x 1220mm (4' x 4') unit: 0.75m² (8.03 sq.ft.)

.6 Percentage of Free Area: 50.3%

.7 Wind Driven Rain Water Penetration Data:

.1 Effectiveness Ratio: 99.8% Class "A" Rating)

.8 Basis of Design Product: Model R7355 Storm Resistant Drainable Louver by TenPlus Architectural Products Ltd.

.2 127mm (5") deep fixed type, storm resistant aluminum louver, with 6063-T52 aluminum alloy extrusion, and as described in the following performance criteria:

.1 Certification: Louver AMCA tested, certified and licensed to bear the AMCA seal for the following:

.1 Air performance

.2 Water penetration

.3 Wind driven rain

.2 Extrusion Thickness:

.1 Head, Sill, Jambs and Mullions: Minimum 2mm (0.080") thick.

.2 Blades: Minimum 1.77mm (0.070") thick.

.3 Louver Type: Mullion construction

.4 Blade Angle: 45º

.5 Free Area - 1220mm x 1220mm (4' x 4') unit: 0.70m² (7.54 sq.ft.)

.6 Percentage of Free Area: 47.1%

.7 Wind Driven Rain Water Penetration Data:

.1 Effectiveness Ratio: 99.8% (Class "A" Rating)

.8 Basis of Design Product: Model R5455 Storm Resistant Drainable Louver by TenPlus Architectural Products Ltd.

2.4 ACCESSORIES

.1 Sill Flashing: Provide sill flashing of same material and finish as adjacent louver, as approved by the Consultant.

.2 Structural Support:

.1 Louver Support: Designed and furnished by louver manufacturer to support wind load of 955 Pa (20 psf) unless others specified.

.2 Support Angle: Louvers openings greater then 3m (10') high require horizontal girt at mid span, as indicated in Section 05 50 00 – Miscellaneous Metals.

.3 Bird Screens:

.1 12mm (1/2") opening, 1.13mm (0.044") re-galvanized steel wire mesh, in an extruded aluminum frame. Removable screen frame to be independent to louver assembly, attaching to the interior face of the louver, providing continuous coverage.

.2 12mm (1/2") opening, 1mm (0.050") thick aluminum expanded metal mesh in an extruded aluminum frame. Removable screen frame to be independent to louver assembly, attaching to the interior face of the louver, providing continuous coverage.

.3 12mm (1/2") opening, 1.6mm (0.063") diameter aluminum wire intercrimp screen in an extruded aluminum frame. Removable screen frame to be independent to louver assembly, attaching to the interior face of the louver, providing continuous coverage.

.4 Insect Screens:

.1 Supply manufacturer's standard aluminum mesh insect screen, welded to aluminum frame. Removable screen frame to be independent to louver assembly, attaching to the interior face of the louver, providing continuous coverage.

.5 Blank-Off Panels:

.1 Insulated Blank-off Panels:

.1 Aluminum faced prefinished insulated blank-off panels, consisting of 51mm (2") thick semi rigid, mineral wool core insulation, having an R value of R-4.2/1". Ensure insulation is continuous and applied around all penetrations and building elements including structural supports.

.2 Facing Panels: 1mm (0.040") thick aluminum sheets, formed and mitered at the corners, with edges overlapped. Seal all perimeters and joints between insulated panels with a neoprene gasket or caulked with an approved material to prevent air infiltration.

.3 Finish:

.1 Exterior face sheet: Finished to match adjacent louver.

.2 Interior face sheet: Mill finish.

.2 Non-Insulated Blank-off Panels:

.1 Facing Panels: 1mm (0.040") thick aluminum sheet blank-off panel.

.2 Finish:

.1 Exterior face sheet: Finished to match adjacent louver.

.2 Interior face sheet: Mill finish.

2.5 FABRICATION

.1 Fabricate as required for optimum performance with respect to water penetration, strength, durability and uniform appearance.

.2 Fabricate louvers to outside dimensions indicated, with allowance of 10mm (3/8”) on each side for sealant joints. Coordinate size, location and placement of units, with installer, prior to fabrication.

.3 Fabricate louvers to minimize field adjustments, splicing, mechanical joints and field assembly of units. Assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.

.4 Clearly mark units for assembly and coordinated installation. Include vertical structural supports, where required.

.5 Provide vertical mullions of type and spacing indicated but not greater than 1524mm (5') o/c. Mechanically assemble louvers using stainless steel or zinc plated steel fasteners recommended by manufacturer.

.6 Provide supports, anchors and accessories required for a complete assembly.

2.6 FINISHES

.1 Clear Anodized Finish:

.1 Class II Finish: Architectural Class II, clear coating 0.010mm (0.00039") or thicker in accordance with AAMA 611.

.2 Coloured Anodized Finish:

.1 Class I Finish: Architectural Class I, integrally coloured or electrolytically deposited colour coating 0.018mm (0.0007") or thicker in accordance with AAMA 611.

.2 Class II Finish: Architectural Class II, integrally coloured or electrolytically deposited colour coating 0.010mm (0.00039") or thicker in accordance with AAMA 611.

.3 Colour: As selected by the Consultant from the manufacturer’ standard colour offering.

.3 High Performance Organic Finish:

.1 2 Coat PVDF Coating: AA-C12 Chemical Finish, cleaned with inhibited chemicals; C40 Chemical Finish, conversion coating; R1x Organic Coating, manufacturer's standard 2 coat, thermo-cured system consisting of specially formulated inhibitive primer and fluoropolymer colour topcoat containing not less than 70% PVDF resin by weight; prepare, pre-treat, and apply coating to exposed metal surfaces in accordance with AAMA 2604 and with coating and resin manufacturers' written instructions.

.1 Colour: As selected by the Consultant from the manufacturer’s standard colour offering.

.2 Basis of Design Material: PPG Duranar by PPG Industries.

.2 3 Coat PVDF Coating: AA-C12 Chemical Finish, cleaned with inhibited chemicals; C40 Chemical Finish, conversion coating; R1x Organic Coating, manufacturer's standard 3

coat, thermo-cured system consisting of specially formulated inhibitive primer, fluoropolymer colour coat, and clear fluoropolymer topcoat, with both colour coat and clear topcoat containing not less than 70% PVDF resin by weight; prepare, pre-treat, and apply coating to exposed metal surfaces in accordance with AAMA 2605 and with coating and resin manufacturers' written instructions.

.1 Colour: As selected by the Consultant from the manufacturer's standard colour offering.

.2 Basis of Design Material: PPG Duranar XL by PPG Industries.

.4 Exposed Steel Finishing:

.1 Shop Primer for Ferrous Metal: Organic zinc rich primer, ready for finish painting by Section 09 90 00 – Painting.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Examine openings to receive work and surrounding adjacent surfaces for conditions affecting installation. Coordinate with related sections providing openings to ensure proper dimensions are maintained.

.2 Verify dimensions of supporting structure by accurate field measurements so that work will be accurately designed, fabricated and fitted to the structure.

.2 Notify Contractor in writing of any conditions that are not acceptable.

.3 Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

3.2 INSTALLATION

.1 Comply with manufacturer's instructions and recommendations for installation of the work, as shown on approved Shop Drawings.

.2 Anchor louvers to the building substructure as indicated on Shop Drawings and architectural drawings.

.3 Erection Tolerances:

.1 Maximum variation from plane or location shown on the approved shop drawings 3mm in 3048mm (1/8" in 10').

.2 Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line: 1.6mm (1/16").

.3 Erection tolerances shall prevail under both load and no load conditions.

.4 Cut and trim component parts during erection only with the approval of the manufacturer, and in accordance with the manufacturer' recommendations. Restore finish completely.

.5 Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

.6 Set units level, plumb and true to line, with uniform, tight joints to adjacent work.

.7 Provide necessary fastenings, anchors, clip angles, sills and sill flashings required to complete the installation.

3.3 PROTECTION

.1 Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.4 CLEANING

.1 Progress Cleaning: Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.

.2 Final Cleaning: At completion of installation, clean all surfaces so they are free of foreign matter using cleaners recommended by material manufacturer.

.3 Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Consultant, remove and replace damaged systems with new at no additional cost to the Owner.

.4 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 The work in this section includes supply and installation for the following:

.2 Tiling and bonding systems for floor and wall tile including:

.1 Ceramic (CT)

.2 Porcelain (PCT)

.3 Waterproof membrane

.4 Crack isolation membrane

.5 Tile bonding accessories

.6 Site quality control

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American National Standards Institute/Ceramic Tile Institute (ANSI/CTI):

.1 ANSI/CTI A108.1, Specification for the Installation of Ceramic Tile: Collection of 20 ANSI/CTI A108, A118 and A136 Series of Standards on Tile Installation

.3 American Society for Testing and Materials (ASTM):

.1 ASTM C241/C241M, Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic

.2 ASTM C615/C615M, Standard Specification for Granite Dimension Stone

.3 ASTM C627, Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

.4 ASTM C920, Standard Specification for Elastomeric Joint Sealants

.5 ASTM C1028, Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

.6 ASTM C1178/C1178M, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-75.1, Tile, Ceramic

.5 Terrazzo, Tile and Marble Association of Canada (TTMAC):

.1 Specifications Guide 09 30 00, Tile Installation Manual

.2 Hard Surface Maintenance Guide

1.4 PERFORMANCE REQUIREMENTS

.1 Tile products manufactured and tested to ISO 10545 Series and ANSI A137.1.

.2 Slip Resistance: Minimum dynamic coefficient of friction (DCOF) of 0.42 wet to ANSI A137.1.

.3 Floor Traffic Load Bearing Performance: ASTM C627, meeting minimum moderate duty, and outlined in this section and the TTMAC Guide Specification.

.4 Floor flatness tolerances and preparation for large format tiles should be specified in this Section. Specify starting concrete flatness requirements in Section 03 35 10; add additional flatness requirements for tile materials 400 x 400 mm (16 x 16 inches) and larger or where tile manufacturers indicate a higher degree of flatness. Coordinate with the structural engineer when entire floor areas require the tighter flatness tolerance. Modify the following paragraphs to suit specific project requirements.

.5 Surface Flatness Tolerances:

.1 Small Format Floor Tile less than 100 x 100 mm: Floor flatness as specified in Section 03 35 00 – Concrete Finishing.

.2 Standard Format Floor Tile 100 x 100 mm to 400 x 400 mm: Floor flatness measured to a minimum FF35; equivalent to 5 mm with maximum 2 gaps under a 3 m straightedge measurement.

.3 Large Format Floor Tile 400 x 400 mm: Floor flatness measured to a minimum of FF50; equivalent to 3 mm with maximum 2 gaps under 3 m straightedge measurement.

.4 Wall Tiles: Wall levelling similar to floors tiles having similar sizes listed above.

1.5 PRE-INSTALLATION CONFERENCE

.1 Contractor shall hold pre-installation conference 2 weeks prior to commencing work of this Section. Conference shall be attended by the Contractor, Owner, Consultant, concrete finishing subcontractor, tile installers and tile manufacturer's representative, setting bed and grout manufacturer's representative to discuss the following, but not limited to the following;

.1 Substrate conditions, non-structural cracks, structural cracks and preparation requirements.

.2 Floor and wall surface irregularities and levelness tolerances, including all remedial requirements.

.3 Installation of anti-fracturing membranes and setting bed materials.

.4 Installation of tiles and grouting.

.5 Edge details and treatments.

.6 Installation of tile and grout sealers.

.2 Contractor shall ensure that manufacturer's representatives issues written installation instructions at the pre-installation conference, to all parties attending the pre-installation conference and the Consultant, for all tile types, setting beds, grouts and sealers required for the work of this Section.

.3 Contractor shall within 72 hours of the pre-installation conference, prepare minutes of the conference, and issue minutes to all parties attending the pre-installation conference and the Consultant. Contractor shall clearly indicated required actions and by which party.

1.6 SUBMITTALS FOR REVIEW

.1 Product Data: For each product. Include installation instructions for using setting materials and grouts.

.2 Shop Drawings: Plans indicating details of special fittings, expansion joints, control joints, and joint layout, graining orientation of tile, and pattern.

.3 Samples:

.1 Submit sample panel of each type and colour tile, 610 mm x 610 mm (24" x 24"). Adhere to a rigid board with setting compound, grout and a dummy control joint showing sealant as specified. Identify samples by project number, date, name of sub-contractor and tile type. Tile and grout used in the building shall correspond to appearance of approved samples in all respects. Do not install tile until samples are approved.

.2 Upon Consultant's request submit samples of base, trim and fittings.

1.7 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements.

.2 Tile setting material manufacturer's review report.

.3 Field test reports.

1.8 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.9 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide a minimum 3 percent of total of each type and of each colour of floor tile and trim used from same production run for project maintenance upon completion. Provide 2 boxes of each type and colour of wall tile. Neatly package and identify materials and deliver to location specified by Owner.

1.10 QUALITY ASSURANCE

.1 Perform work in accordance with TTMAC Specification Guide, Tile Installation Manual.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

.4 Tile Setting Material Manufacturer's Review:

.1 Prior submitting Submittals obtain tile setting manufacturer’s review and approval for conformance of tile installation methods and procedures with warranty requirements.

.2 Prepare and submit report signed by the tile setting manufacturer.

.3 Review of waterproofing membrane installation, and provide required testing ensuring waterproofing membrane manufactures recommended thickness is achieve.

1.11 MOCK-UP

.1 Provide:

.1 1500 x 1500 mm mock-up of a sample installation illustrating in a cutaway fashion the floor tile, wall tile, accent tile (as required), base and grout for the following:

.2 Washroom floor and wall.

.2 Build mock-ups using personnel, materials, and methods of construction that will be used at Project site

.3 Locate where directed by Consultant.

.4 Allow for multiple iterations until mock-up approved by Consultant.

.5 Retain approved mock-ups as standard of quality for installation.

1.12 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Restrict traffic by other trades during installation.

.5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 4" and taped.

.6 Heavily travelled areas shall have additional 13 mm (1/2") thick fibreboard sheet protection with taped joints over polyethylene sheet protection as specified above.

.7 Protect exposed edges of floor tile with same thickness as tile x 102 mm (4") wide tapered strip of plywood adhered to floor until adjoining floor finish is to be installed.

1.13 SITE CONDITIONS

.1 Ambient Conditions: Apply tile after completion of work by other Sections is complete; to surfaces sufficiently dry, clean, firm, level, plumb and free from oil or wax or any other material deleterious to tile adhesion and as follows:

.1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.

.2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.

1.14 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of five (5) years from date of Substantial Performance, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining, pitting, splitting and deformation of tiles and grout.

2 Products

2.1 MATERIALS – CERAMIC TILE (CT)

.1 Provide Material Meeting ANSI A137.1, and ISO 13006.

.2 Slip Resistance: Required.

.3 Provide coved tile bases, nosings, moulded trimmers for external and internal angles and projections as shown in Drawings.

.4 Refer to Schedule of Finishes for type, product, size, colour and finish textures.

2.2 MATERIALS – PORCELAIN TILE (PCT)

.1 ANSI 137.1; cushion edges; colour through rectified porcelain tiles.

.2 Slip Resistance: Required.

.3 Tile Trim: Provide coved tile bases, nosings, finger grip, toe grip, moulded trimmers for external and internal angles and projections as shown in Drawings.

.4 Refer to Schedule of Finishes for type, product, size, colour and finish textures.

2.3 MORTAR AND GROUT MATERIALS – GENERAL

.1 Acceptable Tile Setting Materials: Subject to conformance to requirements, mortar and grout materials listed below shall be of a uniform quality for each adhesive, and grout component from a single manufacturer and each aggregate from one source or producer as follows:

.1 Laticrete International Inc.,

.2 Mapei Corporation,

.3 TEC Incorporated Building Products Group, an H.B. Fuller Company,

.4 Flextile Ltd.

.2 Setting and Grouting Materials: Conform to material standards in ANSI's Specifications for the Installation of that apply to materials and methods specified.

.1 Grout Colours: Unless otherwise indicated, to be selected by Consultant.

.2 Grout joints: for stone floor tiles provide grout material capable of maintaining maximum 3 mm grout joints.

.3 Source limitations: All materials shall be from one manufacturer, forming a complete system.

.4 Products: Provide like products from same production run. Install products in sequence from sequentially numbered dye lots.

2.4 MORTAR AND GROUT SETTING SYSTEMS

.1 Public Washroom Floors, and other floors not containing showers listed below, concrete substrate: TTMAC Detail 311F-2019-2021-A, and ANSI A108/A118/A136.1.

.2 Concrete and Concrete Block Walls: TTMAC Detail 303W-2019-2021.

.3 Walls with Glass-Mat, Water-Resistant Backing Board (Tile Backing Panels) on Metal Stud Wall Framing: TTMAC Detail 305W-2019-2021-B.

.4 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:

.1 Thinset Mortar:

.1 4237 latex additive and 211 Crete filler powder by Laticrete,

.2 Kerabond with Keralastic by Mapei ,

.3 TA 382 Ultimate LFT by TEC, HB Fuller.

.4 ‘51 Premium Wall & Floor Thin-Set Mortar with 44 Acrylic Additive’ by Flextile.

.2 Trowelable Underlayment and screed Compound:

.1 226/3701 mortar mix by Laticrete,

.2 Topcem by Mapei, or

.3 TA 305 Fast Set Deep Patch by TEC, HB Fuller.

.4 FAST-SET SCREED BY Flextile

.3 Grout: ANSI A108/A118/A136.1:

.1 Standard for dry locations:

.1 SPECTRALOCK PRO Premium Grout by Laticrete, or

.2 Mapei UltracolorPlus, or

.3 PowerGrout by TEC, HB Fuller or

.4 1600 RSG by Flextile

.2 Epoxy Grout: Public Washrooms

.1 SPECTRALOCK PRO Premium Grout by Laticrete, or

.2 Kerapoxy by Mapei,

.3 AccuColour EFX by TEC, HB Fuller.

.4 FLEX-EPOXY 100 GROUT by Flextile

.4 Crack suppression membrane type 1 and type 2 as required.

2.5 TILE SETTING SYSTEMS FOR WET AREAS

.1 Showers and shower change room area to comply with: TTMAC Detail 317-SP-2019-2021.

.2 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:

.1 Scratch/Skim/ Bond Coat:

.1 211/4237 by Laticrete,

.2 Kerabond mixed with Keralastic additive by Mapei,

.3 TA392/393 SUPERFLEX ULTRA PREMIUM THIN SET by TEC

.4 #51 FLOOR & WALL PREMIUM MORTAR MIXED #44 ACRYLIC ADDITIVE by Flextile

.2 Mortar Bed/levelling coat: For bed thicknesses over 40 mm, suspend reinforcing mesh within mortar bed.

.1 226/3701 mortar mix by Laticrete,

.2 Topcem with Planicrete AC by Mapei,

.3 TA305 FAST SET DEEP PATCH WITH PATCH ADDITIVE by TEC,

.4 FAST-SET SCREED or 4:1 DRY PACK with #44 Acrylic Additive by Flextile

.3 Waterproof Membrane: ANSI A118.10

.1 Hydroban by Laticrete

.2 Aquadefense by Mapei

.3 TA 316 Hydraflex by TEC, HB Fuller

.4 WP-900 HYDRO-BLOCK by Flextile

.4 Grout: ANSI A108/A118/A136.1 Epoxy Grout:

.1 SPECTRALOCK PRO Premium Grout by Laticrete

.2 Kerapoxy by Mapei

.3 AccuColour EFX by TEC, HB Fuller

.4 FLEX-EPOXY 100 GROUT by Flextile

.5 Fibreglass reinforcing mesh and cleavage membrane, as recommended by manufacture.

2.6 ACCESSORIES

.1 Water: Fresh, clean, potable, free from deleterious matter, acids or alkalis.

.2 Sealant: movement and joint sealants as specified in Section 07 92 00 –Sealants.

.3 Trims:

.1 Straight Edge Strips: [Solid brass] [Extruded clear satin anodized aluminum] [Roll formed stainless steel] edge strips, 3 mm wide at top edge; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material:

.1 Basis-of-Design Materials: Schlüter Schiene AE

.2 Transition Edge Strips: [Solid brass] [Extruded mill finished clear satin anodized] aluminum] edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material and [sloped] [sloped, narrow profile] [sloped, wide profile] [flat, smooth profile] transition

.1 Basis-of-Design Materials: Schlüter Reno [[M] [A] [AMB] [ACB]]-[[U] [TK] [UK] [T]

.3 Cove Base Trims: Roll formed stainless steel inside corner, cove shaped joint profile with perforated anchoring legs for setting the corner joint into the setting material; heights as required to suit installation, complete with pre-formed outside corners, [pre-formed 3-way inside corners], pre-formed 2-way inside corners, connections, and pre-formed end caps:

.1 Basis-of-Design Materials: Schlüter Dilex [EHK] [EHKS].

.4 Provide fillers, primers, reinforcing fabric and all other materials and accessories as recommended by the crack suppression membrane manufacturer.

.5 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:

.1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturer’s recommendations and as recommended by tile manufacturer.

.2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer’s recommendations.

2.7 CRACK SUPPRESSION MEMBRANE

.1 Crack Suppression Membrane Type 1 (For non-structural cracks less than 3 mm wide). Provide one of the following, or equivalent from listed manufacturer:

.1 One component, water based, elastomeric type crack suppression membrane capable of spanning cracks up to 3 mm wide without failure.

.1 ‘Plani/Lastic’ by Mapei Canada Inc., or

.2 WP-900 WATER PROOF & CRACK ISOLATION MEMBRANE by Flextile

.3 Or Consultant reviewed substitution from by listed manufacture.

.2 One component, liquid rubber, elastomeric type crack suppression membrane reinforced with reinforcing fabric and capable of spanning cracks up to 3 mm wide without failure.

.1 ‘Laticrete 9235 Anti-Fracture Membrane’ by Laticrete International Inc. or

.2 ‘TA 316 Hydraflex’ by TEC, HB Fuller.

.3 WP-980 WATERPROOF & CRACK ISOLATION MEMBRANE by Flextile

.4 Or Consultant reviewed substitution from by listed manufacture.

.2 Crack Suppression Membrane Type 2 (For non-structural cracks 3 mm wide and greater, and all structural cracks). Provide one of the following, or equivalent from listed manufacturer:

.1 Two component, elastomeric type crack suppression membrane reinforced with reinforcing fabric and capable of spanning cracks 3 mm wide and greater without failure.

.1 'Planicrete W' by Mapei Canada Inc., or

.2 Or Consultant reviewed substitution from by listed manufacture.

.2 One component, liquid rubber, elastomeric type crack suppression membrane reinforced with reinforcing fabric and capable of spanning cracks 3 mm wide and greater without failure.

.1 'Laticrete 9235 Anti-Fracture Membrane' by Laticrete International Inc. or

.2 'TA 316 Hydraflex' by TEC, HB Fuller.

.3 WP-980 WATERPROOF & CRACK ISOLATION MEMBRANE by Flextile

.4 Or Consultant reviewed substitution from by listed manufacture.

2.8 MORTAR AND GROUT MIXING

.1 Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

.2 Add materials, water, and additives in accurate proportions.

.3 Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated or specified.

2.9 TILE SCHEDULE

.1 Floor Tile (FT):

.1 Acceptable Product: Masterpiece Atelier by Stone Tile.

.2 Material: Porcelain.

.3 Colour and Finish: Master Coal Night Sky, Matte finish.

.4 Size: 300 mm x 600 mm x 8 mm

.2 Wall Tile (WT):

.1 Acceptable Product: Cesi I Colori by Stone Tile.

.2 Material: Ceramic.

.3 Colour and Finish: Talco, Glossy finish.

.4 Size: 100 mm x 300 mm x 9 mm

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work.

.1 Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated or specified.

.2 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

.3 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Consultant.

.3 Verify sealants and grout are cured for manufactured recommended periods at required temperatures and relative humidity conditions before water immersion.

.4 Crack Suppression Membranes:

.1 Prepare all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.

.2 Prime and fill all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.

.5 Commencement of installation shall signify complete acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Surface Preparation:

.1 Make backing surfaces level and true to a tolerance in plane of ± 3 mm in 2 m (1/8” in 8’) for walls and ± 3 mm in 3 mm (1/8” in 10’) for floors using levelling bed mortar.

.2 Surfaces shall be structurally sound, well fastened, clean and free from dust, oil, grease, paint, tar, wax, curing agents, primers, sealers, form release agents or any deleterious substances that may act as bond barriers.

.3 Backing surfaces shall be dry and fully cured. Dampness must not exceed 5% by volume.

.2 Examine concrete substrate, repair as required to produce level, clean surface for new tile installation. Repair Work shall include levelling, filling, grinding or cutting, in accordance with Section 03 35 00 – Concrete Finishing.

.3 Work of other trades that are required before new tile installation (i.e. electrical conduit installed below ceramic tile) shall be installed, complete and approved before tile installation.

.4 Fill cracks, holes, and depressions in concrete substrates for tiling installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

.5 Check as per ASTM F710 for Concrete Preparation for excessive moisture levels & pH of the slab.

3.3 INSTALLATION - GENERAL

.1 Installation of the tile shall be by thin-set method, as indicated on the drawings and as specified herein;

.1 Install wall tile to gypsum wallboard and moisture resistant wallboard in dry areas using latex modified thin-set setting bed and latex modified wall grout in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.

.2 Apply floor tile and prepare floor slabs in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.

.2 Install mortar bed, tile, and grout to referenced TTMAC Manual and TTMAC systems listed.

.3 Thoroughly clean surfaces to which tile is to be applied.

.4 Back butter all floor tile.

.5 Neatly cut tile around fitments, fixtures, access panels, and the like. Splitting of tile is expressly prohibited except where no alternative is possible. Form intersections, corners and returns accurately.

.6 Finish surfaces flat and level or, sloped and graded as required.

.7 Joint Widths: Install tile with the following joint widths, unless indicated on drawings:

.1 Ceramic Mosaic Tile: 2 mm (1/16”)

.2 Wall Tile: 2 mm (1/16”)

.3 Floor Tile: 6 mm (1/4”), unless otherwise indicated on the Drawings.

.4 Quarry Tile: 6 mm [1/4”] 8 mm [5/16”] 9.5 mm [3/8”]

.5 Make joints consistent width and alignment within tile area.

.6 Maintain 2/3 of grout joint depth free of setting material.

.8 Joints in base shall match floor patterns. Joints shall be watertight without voids, cracks or excess grout.

.9 Lay out tile so that fields or patterns are centred on wall areas or architectural features and so that no tile less than 1/2 size occurs.

.10 Arrange and set recessed accessories in tile work so that they are evenly spaced, centred with joints and set true with correct projection. Rigidly install accessories.

.11 Provide manufacturer's standard trim pieces at changes of direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions:

.1 Internal horizontal corners: Coved.

.2 External vertical and horizontal corners: Bullnosed.

.3 Internal vertical corners and unexposed edges: Square.

.12 Install tiles in patterns and locations as indicated on drawings.

.13 Install wall tile full wall height unless shown otherwise.

.14 Coordinate work of this Section with work of other Sections for items requiring to be recessed into work of this Section.

.15 Sound tiles after setting and remove and replace tiles not fully bedded.

.16 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.

.17 Finished tile work shall be clean and free of tiles which are pitted, chipped, cracked or scratched. All damaged tile shall be removed and replaced.

.18 Where indicated on Drawings or as required, install continuous single piece metal edge trims centred under doors in closed position and other locations where tile meets other floor finishes.

.19 Allow tile to set for a minimum of 48 hours prior to grouting.

3.4 GROUTING

.1 Grout tiles in accordance with ANSI A108.10 and as specified herein.

.2 When grouting a fresh laid floor, make certain that traffic and grouting will not cause movement of floor in setting bed. Protect floor by using kneeling boards or gypsum board to defend floor against traffic while grouting.

.3 Mix grouts and install in strict accordance with the manufacturer's instructions.

.4 Excess grout shall be removed from the surface of tiles using the edge of a rubber float held at a 45 deg angle, moving it diagonally to the joints. Fill all gaps and air holes.

.5 Do not allow grout to harden on face of tile. Refer to manufacturer's instructions for thorough removal.

.6 Floors which required damp curing shall be cured for the required length of time using heavy kraft paper, not polyethylene sheets. Consult manufacturer for instructions.

3.5 CONTROL JOINTS AND SEALING

.1 Control joints of a flexible caulking material shall be placed every 4877mm to 6096mm (16 to 20') apart, directly over existing control joints and/or where indicated on drawings or as required in accordance with TTMAC Detail No. 301MJ-2019-2021, Details E, F and G, whichever is applicable. Control joints shall be placed around the floor perimeter at walls, around columns, and where tile abuts other hard materials or vertical surfaces. Saw cutting of tile after installation is prohibited. Tile shall be cut if required and installed along each side of control joints.

.2 Expansion joints must always be placed directly over all slab expansion joints in accordance with TTMAC Detail No. 301MJ-2019-2021, Details A and B, whichever is applicable.

.3 Locate expansion, control, contraction, and isolation joints, as indicated below, unless specifically indicated otherwise on the Drawings:

.1 Interior: 5 m (16’) maximum: 6 mm (1/4") joint width.

.2 Exterior: 4 m (12’) maximum: 9.5 mm (3/8") joint width.

.4 Joints around fixtures, pipes or other fittings shall be sealed with a sealant. Refer to Section 07 92 00 – Sealants for type of sealants to be used.

.1 Colour of sealant shall match grout as selected later by Consultant.

3.6 WATERPROOFING

.1 Install waterproofing in accordance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

.2 Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.7 CLEANING AND FINISHING

.1 Clean tiled areas after grouting has cured, using compatible solutions and methods as recommended by the manufacturer.

.2 Remove [latex-portland cement] [and epoxy] grout residue from tile as soon as possible.

.3 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation.

.4 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.5 Flush surface with clean water before and after cleaning.

.6 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

3.8 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of:

.1 Acoustical panel ceiling systems (ACT).

.2 Suspended metal grid ceiling system and perimeter trim.

.3 Supplementary acoustic insulation over system units.

.4 Site quality control.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C635/C635M, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

.2 ASTM C636/C636M, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

.3 ASTM E1264, Standard Classification for Acoustical Ceiling Products

.3 Underwriters Laboratories of Canada (ULC):

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

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Suspension System:

.1 Determine the superimposed loads that will be applied to suspension systems by components of the building other than the ceiling and ensure that adequate hangers are installed to support the additional loads in conjunction with the normal loads of the system.

.2 Design supplemental suspension members and hangers where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at required spacing to support standard suspension system members:

.3 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

.4 Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of L/360.

.5 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

.6 Surface-Burning Characteristics: Conform to CAN/ULC S102 or ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate layout and installation of ceilings with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression system.

1.6 SUBMITTALS FOR REVIEW

.1 Product Data: Submit product data for each type of product specified.

.2 Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items indicating the following:

.1 Ceiling suspension system members.

.2 Method of attaching suspension system hangers to building structure.

.3 Ceiling mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special mouldings at walls, column penetrations, and other junctures of acoustic ceilings with adjoining construction.

.3 Samples:

.1 Submit two 300 x 300 mm samples illustrating material and finish of each type of acoustic unit.

.2 Submit two 300 mm long samples of suspension system main runner, cross runner, and perimeter moulding.

1.7 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For Installer.

.2 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.

.3 Professional Structural Engineer’s Letters of Assurance:

.1 Provide letters or completed Owner-prescribed forms signed by the professional structural engineer used to prepare the shop drawings, stating that the ceiling system has been designed accordance with the structural performance requirements of the applicable codes, including verification that:

.1 Specified products have been used.

.2 Designs and installations as tested, have been installed on the Project.

.3 Loads and movement requirements have been achieved.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Acoustical Ceiling Units: Full size units equal to three percent of quantity installed, of each tile type.

.2 Suspension-System Components: Quantity of each concealed grid and exposed component equal to three percent of quantity installed.

1.9 QUALITY ASSURANCE

.1 Conform to Ceilings and Interior Systems Contractors Association (CISCA) Ceiling Systems Handbook requirements.

.2 Qualifications of Installer: Approved by suspension system manufacturer.

1.10 REGULATORY REQUIREMENTS

.1 Conform to applicable code for combustibility requirements for materials.

.2 Conform to applicable code for seismic requirements for ceiling system.

1.11 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

1.12 SITE CONDITIONS

.1 Ambient Conditions: Install acoustic unit ceilings only when building is enclosed, has sufficient heat, when overhead mechanical and electrical work is complete, and dust and moisture producing activities are complete; maintain uniform temperatures and relative humidity within range recommended by material manufacturer from the time of installation until Substantial Performance for the project; make adjustments to temperature and humidity gradually within tolerances indicated by manufacturer.

1.13 WARRANTIES

.1 Provide two (2) year warranty by manufacturer of acoustic panels covering defects in products and failure to meet specified requirements.

2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include the following:

.1 Armstrong World Industries Canada Ltd,

.2 CertainTeed Gypsum Canada Inc. a Division of Saint-Gobain, or

.3 CGC Inc. a USG Company.

.4 Rockfon LLC.

2.2 METAL SUSPENSION SYSTEMS

.1 Grid Components: ASTM C635/C635M, intermediate duty; exposed, downward access removable T; components die cut and interlocking; minimum 38 mm high bulb tee design.

.1 Recycled Content: minimum 50 %

.2 Grid Materials: Hot dip galvanized steel with factory paint finishes.

.3 Grid Finish: White, manufacturer’s standard.

.4 Module: Sized as appropriate to acoustic panel size.

.5 Mouldings:

.1 Perimeter Moulding: Formed to provide shadow reveal profile moulds unless shown otherwise in baked white enamel finish.

.6 Exposed Suspension System (Type 1): Provide standard exposed 'T' bar system: zinc-coated steel with baked white enamel finish for exposed surfaces in colour to match acoustic panels.

.1 Acceptable Products:

.1 'Prelude XL HRC' manufactured by Armstrong World Industries Canada Ltd.

.2 '15/16" Classic Stab System' by CertainTeed Gypsum Canada.

.3 DONN Brand Suspension System, 25 mm exposed face; 'Donn DX/DXL HRC' by CGC Inc. or

.4 'Chicago Metallic 1200HRCMax 15/16" Stab System' by Rockfon LLC.

.7 Narrow Suspension System (Type 2): Provide standard two-directional thin-line bolt slot bar system with 6 mm reveal: zinc-coated steel with baked white enamel finish for exposed surfaces in colour to match acoustic panels.

.1 Acceptable Products:

.1 'Silhouette XL 9/16-inch' manufactured by Armstrong World Industries Canada Ltd.,

.2 '15 mm Smoothline Bolt Slot' manufactured by CertainTeed Gypsum Canada,

.3 'Fineline DXF' manufactured by CGC Inc.

.4 'Chicago Metallic 4500 Series' by Rockfon LLC.

.8 Narrow Suspension System (Type 3): Provide standard two-directional thin-line T bar system with zinc-coated steel with baked white enamel finish for exposed surfaces in colour to match acoustic panels.

.1 Acceptable Products:

.1 'Suprafine XL 9/16-inch' manufactured by Armstrong World Industries Canada Ltd.,

.2 '9/16" Elite Narrow Stab' manufactured by CertainTeed Gypsum Canada,

.3 'Centricitee DXT' manufactured by CGC Inc. or

.4 'Chicago Metallic 4000 Tempra™ 9/16" Exposed' by Rockfon LLC.

.9 Integrated ceiling system (Type 4): Integrated ceiling system that organizes technical services; Provide standard two-directional thin-line bolt slot bar system with 6 mm reveal.

.1 Acceptable Products:

.1 'TechZone Ceiling Systems' with 'Silhouette XL' by Armstrong World Industries Inc. or

.2 'Logix Integrated Ceiling Systems' with 'Fineline DXF' by CGC Inc.

.3 Approved alternative by CertainTeed Gypsum Canada, or Rockfon LLC.

2.3 ACOUSTIC CEILING PANELS (ACT)

.1 Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by the nominal values for types, patterns, acoustic ratings, and light reflectance class, unless otherwise indicated.

.2 Surface burning properties, all types: Flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with CAN/ULC S102, substantiated by ULC labels on materials supplied.

.3 Acoustic Panel (ACT): ASTM E1264, Type XII, Form II, Pattern G:

.1 Performance:

.1 NRC: Min. [0.85][0.70].

.2 Thickness: 19 mm.

.3 Surface Texture: Fine.

.4 Surface Colour: White.

.2 Edge Profile: [Tegular][Square].

.3 Sizes: [610 x 1220 mm] [610 x 610 mm].

.4 Suspension System: Type [#]

.5 Approved Products:

.1 'OPTIMA Open Plan series' manufactured by Armstrong World Industries Canada Ltd.,

.2 'Symphony f series ' by CertainTeed Gypsum Canada,

.3 'Halcyon ClimaPlus series' manufactured by CGC Inc.,

.4 'Sonar' by Rockfon LLC.

2.4 ACCESSORIES

.1 Accessories: Stabilizer bars, clips, perimeter mouldings and splices required for suspended grid system.

.2 Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

.3 Ties Wire: minimum 1.98 mm (14 ga.) Ø steel wire, galvanized.

.1 Hanger Attachments to Concrete: 1 #12 galvanized annealed steel wire for support of a maximum weight of 68 kg. per hanger; #9 galvanized annealed steel wire for support of a maximum weight of 140 kg. per hanger; 4.5 mm diameter galvanized annealed steel rod to support a maximum weight of 250 kg. per hanger.

.4 Anchors: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency; Minimum tensile strength 390 MPa.

.5 Acoustic Sealant for Perimeter Mouldings: As specified in Section 07 92 00 – Sealants.

.6 Edge Trim:

.1 'Axiom Classic Trim' by Armstrong World Industries Canada Ltd. or equivalent by a listed suspension system manufacturers.

.1 Height: 50 mm and 102 mm high as indicated.

.2 Colour: White.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION – GENERAL

.1 Install acoustical ceilings according to CISCA publication Ceiling Systems Handbook.

3.3 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

.1 Install suspension system to manufacturer instructions and ASTM C636/C636M, and as supplemented in this section.

.2 Install system in accordance with ASTM E580/E580M.

.3 Install system capable of supporting imposed loads to a deflection of L/360 maximum.

.4 Lay out system to a balanced grid design with edge units no less than 50 percent of acoustic unit size, unless otherwise detailed.

.5 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

.6 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

.7 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

.8 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.

.9 Do not eccentrically load system, or produce rotation of runners.

.10 Perimeter Moulding:

.1 Install edge moulding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.

.2 Use longest practical lengths.

.3 Overlap corners.

.4 Provide at junctions with other interruptions.

3.4 INSTALLATION - ACOUSTIC UNITS

.1 Install acoustic units to manufacturer's instructions.

.2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

.3 Install units after above ceiling work is complete.

.4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.5 Cutting Acoustic Units:

.1 Cut to fit irregular grid and perimeter edge trim.

.6 Where round obstructions occur, provide preformed closures to match perimeter moulding.

.7 Where indicated, lay acoustic insulation for a distance of 1 200 mm either side of acoustic partitions.

.8 Install panel hold-down clips, where specified, to retain panels tight to grid system.

3.5 ERECTION TOLERANCES

.1 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.

.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 SITE QUALITY CONTROL

.1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located to:

.1 Perform timely and regular inspections.

.2 Verify installation conforms to applicable code.

.3 Prepare and submit inspection reports.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes material and installation requirement of resilient tile to complete the Work of this Contract.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM F1066-04(2014)e1, Standard Specification for Vinyl Composition Floor Tile

.2 ASTM F1869-11, Standard Test Method for Measuring Moisture Vapour Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Close spaces to traffic during flooring installation and until time period after installation recommended in writing by manufacturer; install flooring after other finishing operations, including painting and ceiling construction have been completed.

.2 Pre-Installation Conference: Conduct conference at Project site, to verify project requirements, substrate conditions, patterns and layouts, coordination with other Sections affected by work of this Section, manufacturer’s installation instructions and manufacturer’s warranty requirements.

1.5 SUBMITTALS

.1 Action Submittals:

.1 Product Data: Submit one copy of product data for each type of product specified.

.2 Shop Drawings: Submit shop drawings indicating:

.1 Location of seams and edges

.2 Location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cut-out locations

.3 Type and style of resilient transition strip used between adjacent flooring types

.3 Samples for Verification:

.1 Resilient Flooring: Submit samples of each different specified product for verification of colour and pattern in manufacturer's standard size, but not less than 6” x 6” in size for tile or sheet material, or 6” long for resilient accessories.

.2 Informational Submittals: Provide the following submittals during the course of the work:

.1 Site Quality Control Test Results: Submit results or moisture emission testing of concrete subfloors prior to installation of flooring. Results shall include comparison of manufacturer’s recommended moisture content to actual moisture vapour emission rate.

.3 Maintenance Data and Operating Instructions:

.1 Operation and Maintenance Data: Submit manufacturer’s written instructions for maintenance and cleaning procedures, include list of manufacturer recommended cleaning and maintenance products, and name of original installer and contact information.

.4 Safety Data Sheets:

.1 Submit WHMIS safety data sheets for incorporation into the Operation and Maintenance Manual. Keep one copy of WHMIS safety data sheets on site for reference by workers.

1.6 QUALITY ASSURANCE

.1 Contractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Resilient Flooring Installer: Use an installer who is competent in heat welding and have a minimum of five (5) years documented experience in the installation of resilient sheet flooring and seams in accordance with manufacturer’s training or certification program:

1.7 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with Construction Schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Restrict traffic by other trades during installation.

.5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of kraftpaper.

1.8 ENVIRONMENTAL CONDITIONS

.1 Temperature of room, floor surface and materials shall not be less than 21 deg C for 48 hours before, during and for 48 hours after installation. Concrete floors shall be aged for a minimum of 28 days and shall be dry before application of the resilient floor tile.

.2 Moisture content of floor shall not exceed a maximum of 3 lbs. of water per 1,000 sq. ft. of concrete slab area over a 24 hour period as measured by one of the following methods, as approved by Consultant:

.1 Rubber Manufacturer's Association (RMA) moisture test using anhydrous calcium chloride.

.2 Does not exceed 3% as measured by Calcium Carbide Hygrometer procedure.

.3 Does not exceed 5% as measured by normal Protimeter.

.3 Avoid exposure to high humidity, cold drafts and abrupt temperature changes.

1.9 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions but for an extended period of five (5) years and agree to repair or replace faulty materials or work which become evident during warranty period without cost to the Owner. Defects shall include, but not limited to, bond failure, and extensive colour fading.

2 Products

2.1 MANUFACTURERS

.1 Specified Products: Work of this Section is based on products manufactured by Tarkett Canada. Products by other manufacturers similar in function, design, performance, and construction

complying with requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

2.2 TILE FLOORING MATERIALS

.1 Vinyl Composition Floor Tile (VCT): Asbestos free uniform in thickness with uniform colour and pattern through the full thickness, with straight, sharp and square edges and corners, accurately cut to size, conforming to ASTM F1066 and the following:

.1 Product: Tarkett VCT II

.2 Classification: Class 2 – Through Pattern

.3 Colour: 602 Stone Grey

.4 Thickness: 3 mm (1/8")

.5 Size: 305 mm x 305 mm (12" x 12")

3 Execution

3.1 EXAMINATION

.1 Testing and Inspections: Test moisture emission rate of concrete subfloor prior to installing flooring, using the calcium chloride test method in accordance with ASTM F1869.

.2 Examine substrates, areas, and conditions affecting work are in accordance with manufacturer's requirements, and as follows:

.1 Verify that floor surfaces are smooth and flat to plus or minus 1/8" over 10'; notify Consultant in writing where floor tolerances are not within acceptable values.

.2 Verify that concrete slabs exhibit normal alkalinity of between 5 and 9 and that they are free of carbonization or dusting deleterious to flooring installation or adhesive bond.

.3 Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits that could interfere with flooring installation.

3.2 PREPARATION

.1 Comply with resilient flooring manufacturer's written installation instructions for preparing substrates indicated to receive flooring.

.2 Fill cracks, holes, and depressions in substrates using trowellable levelling and patching compounds in accordance with manufacturers written instructions and as follows:

.1 Levelling and patching shall be restricted to correcting minor deviations or imperfections to bring floor surface finish to within flooring manufacturers tolerances for flatness.

.3 Remove coatings from concrete substrates, including curing compounds and other substances that are incompatible with flooring adhesives, and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer; do not use solvents.

.4 Broom and vacuum clean substrates immediately before installing flooring.

3.3 INSTALLATION

.1 Comply with resilient flooring manufacturer's written installation instructions.

.2 Unroll flooring and allow stabilizing before cutting and fitting in accordance with manufacturer's installation instructions.

.3 Apply primer in strict accordance with manufacturer's printed instructions. Permit primer to dry.

.4 Apply adhesive uniformly with an approved notchtooth spreader at the recommended rate. (Mechanical spreader not approved). Do not spread more adhesive than can be covered before initial set takes place. Use waterproof adhesive throughout. Follow manufacturer's instructions.

.5 Layout tile flooring as follows:

.1 Lay tile with joints parallel to building lines to produce a symmetrical tile pattern.

.2 Install tile flooring so that perimeter tile width is minimum 1/2 full size.

.6 Accurately scribe tile around walls, and other floor conditions.

.7 Each type of material used shall be from one manufacturer throughout the work and material in each area shall be of same production run.

.8 Remove and replace loose, damaged and defective tiles where required and as directed by Consultant.

3.4 CLEANING, SEALING AND FINISHING

.1 Cleaning, sealing and finishing of resilient tile flooring shall be performed using the cleaning, sealing and finishing materials specified of one manufacturer in accordance with the manufacturer's instructions and recommendations. Allow a minimum of four (4) days to elapse after completion of each resilient flooring installation before commencing cleaning, sealing, and finishing operations.

.2 Work shall be handed over to the Owner free of blemishes and in perfect condition.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Provide labour, materials, tools and other equipment, services and supervision required to complete interior and exterior, including above roof, painting and decorating work.

.2 Surface preparation for this section will be limited to priming and back-priming, and specific pre-treatments noted in this section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.

1.3 RELATED REQUIREMENTS

.1 Other sections of the specification requiring painting refer to this section. Coordinate requirements of referencing sections.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 Environmental Choice Paints and Surface Coatings, Low VOC Product Listings Program (ECP):

.1 Paints and Surface Coatings, Low VOC Product Listings

.3 The Master Painters Institute (MPI):

.1 New Surfaces: Architectural Painting Specification Manual.

.2 Existing Surfaces: [Interior] [and] [Exterior] Maintenance Repainting Manual[s].

.4 The Society for Protective Coatings (SSPC):

.1 Coating Materials Guidelines

.2 Surface Preparation Guidelines

.3 Application, Inspection and Quality Control Guidelines

1.5 DEFINITIONS

.1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows:

.1 G1: Matte of Flat: Lustreless or matte finish with a gloss range below 10 when measured at 85° to meter and 0 to 5 when measured at 60°.

.2 G2: Velvet: Matte to low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 0 to 10 when measured at 60°.

.3 G3: Eggshell: Low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 10 to 25 when measured at 60°.

.4 G4: Satin: Low to medium sheen with a gloss range of minimum 35 when measured at 85° to meter and 20 to 35 when measured at 60°.

.5 G5: Semi-Gloss: Medium sheen finish with a gloss range of 35 to 70 when measured at 60° to meter.

.6 G6: Gloss: High sheen finish with a gloss range of 70 to 85 when measured at 60° to meter.

.7 G7: High Gloss: Reflective sheen having a gloss range in excess of 85 when measured at 60° to meter.

.2 Gloss Values: Generally, provide paints and coatings having the following sheens when installed on the following substrates:

.1 Walls: Eggshell (G3) or Satin (G4) as selected by Consultant at a later date.

.2 Trim and Doors: Semi-gloss (G5).

.3 Ceilings: Flat (G1).

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit list of all painting materials used for the Work to the Consultant for review prior to ordering materials for each paint system indicated, including block fillers and primers.

.1 Material List: An inclusive list of required coating materials indicating each material and cross reference specific coating, finish system, and application; identify each material by manufacturer's catalogue number and general classification.

.2 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

.2 Samples: Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application, and as follows:

.1 Drawdown Samples: Provide three (3) drawdown sample charts (cards) for each type, texture and colour of finish specified for verification purposes before ordering paint materials.

.3 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Certification: Submit certification reports for paint products indicating that they meet or exceed low VOC and coloured base requirements listed in this Section.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit copies of paint manufacturer’s written maintenance information for inclusion in the operations manual, including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

.2 Maintenance Materials: Deliver maintenance materials to Owner in quantities indicated, that match products installed; packaged with protective covering for storage, and identified with labels describing contents and building location and as follows:

.1 Paints and Coatings: Minimum of 4-4L containers of field colours and 4-1 L containers of each accent colour, and all remnants.

1.8 QUALITY ASSURANCE

.1 Conform to the standards contained in the MPI Manual.

.2 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in service performance, and as follows:

.1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.

.2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.

.3 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:

.1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Conform to MPI Manual and manufacturers requirements.

.2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.

.3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

.4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.

.5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.

.6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.

.7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.10 WARRANTY

.1 Special Warranty: Provide an MPI two (2) year guaranty, or a 100% two (2) year Maintenance Bond in accordance with MPI Manual requirements; painting subcontractors choosing the Maintenance Bond option must provide a maintenance bond consent from a reputable surety company licensed to do business in Canada as follows:

.1 Warrant that painting work has been performed in accordance with MPI Manual requirements.

.2 Provide a cash value to repair or replace defective coatings in the event that the original installer is not able to perform warranty work.

2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers that have attained the prerequisites for ecologically sustainable labelling mark on their products and may be incorporated into the Work include; but are not limited to, the following:

.1 Sherwin-Williams LLC

.2 Benjamin Moore and Co. Limited

.3 ICI Paints (Canada) Inc.

.4 Para Paints

.5 PPG Canada Inc.- Architectural Finishes

.6 SICO Inc.

2.2 MATERIALS

.1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual “Approved Product” listing and shall be from a single manufacturer for each system used.

.2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.

.3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

3 Execution

3.1 PREPARATION OF SURFACES:

.1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

.2 Prepare aluminum surfaces to receive new premium paint finish, where indicated on drawings. Sand, clean and test aluminum surfaces scheduled to receive paint finish under adequate illumination, ventilation and temperature requirements, as recommended by the paint manufacturer to ensure proper adhesion of the paint.

.1 Protect adjacent surfaces from sanding, so not to cause damage to those surfaces.

3.2 APPLICATION

.1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.

.2 Paint [or] [and] [stain] surfaces requiring paint or stain finish to Premium MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.

.3 Continue paint finishes through behind wall mounted items.

.4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer’s recommendations.

.5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

.6 Parking Areas and Pedestrian Areas:

.1 Parking bays lines shall be identified with 102 mm (4") wide white or yellow painted lines with each bay consecutively numbered with 51 mm (2") wide white or yellow painted numbers in accordance with approved parking layout and/or in accordance with the requirements or authorities having jurisdiction.

.2 Barrier free accessible parking bays and refuge areas shall be identified with appropriate symbol designation and/or in accordance with the requirements or authorities having jurisdiction.

.3 Pedestrian walkways shall be identified with 102 mm (4") wide yellow painted lines at 45 degrees to path of travel spaced at 457 mm (18") O/C or in accordance with the requirements or authorities having jurisdiction.

3.3 EXTERIOR SURFACES

.1 Paint exterior surfaces in accordance with the MPI Manual painting systems listed in this section.

.2 Asphalt Surfaces (Zone / Traffic Marking for Drive and Parking Areas):

.1 EXT 2.1A: Latex Zone / Traffic Marking.

.2 EXT 2.1B: Alkyd Zone / Traffic Marking.

.3 Concrete Vertical Surfaces (including horizontal soffits):

.1 EXT 3.1A: Latex [insert gloss] finish.

.2 EXT 3.1B: Latex aggregate [insert gloss] coating.

.3 EXT 3.1C: Water based light industrial coating [insert gloss] finish.

.4 EXT 3.1F: Elastomeric finish.

.4 Concrete Horizontal Surfaces (decks and floors):

.1 EXT 3.2A: Latex floor paint finish.

.2 EXT 3.2B: Latex deck coating.

.3 EXT 3.2D: Alkyd Floor Enamel [insert gloss].

.4 EXT 3.2G: Clear Sealer (for exposed aggregate)

.5 Concrete Masonry Units (smooth and split face block and brick):

SPEC NOTE: Depending on the manufacturer – there is either a coat of block filler (primer) or nothing, and 1 coat of the elastomeric. Any of the MPI #113 coatings listed under MPI EXT4.2D will do the job adequately, they are all flat gloss, water based, vapour permeable coatings.

.1 EXT 4.2D: Elastomeric coating, with block filler or primer as recommended by manufacturer, flat finish.

.2 EXT 4.2C: Water based light industrial coating [insert gloss] finish.

.3 EXT 4.2X: Non-MPI System for clear coating Ground Face Terrazzo Concrete Block Specified in Section 04 81 00 – Unit Masonry Assemblies: Pro-Masonry Clear Sheen [single coat, semi-gloss] [two coat, gloss], Telephone (800) 628-8476

.4 EXT 4.2A: Latex [insert gloss] finish.

.5 EXT 4.2B: Latex aggregate [insert gloss] coating.

SPEC NOTE: Ensure that shop preparation and shop primers for structural steel and miscellaneous metals are compatible with field applied coatings.

.6 Structural Steel and Metal Fabrications:

.1 EXT 5.1A: Quick dry [insert gloss] finish.

.2 EXT 5.1B: Inorganic zinc/water based light industrial coating [insert gloss] finish.

.3 EXT 5.1C: Alkyd metal primer/water based light industrial coating.

.4 EXT 5.1D: Alkyd [insert gloss] finish.

.5 EXT 5.1K: Aluminum paint finish.

.6 EXT 5.1L: Polyurethane pigmented (Over inorganic zinc rich primer and high build epoxy).

.7 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, gutters, flashing, etcetera):

.1 EXT 5.3A: Latex [insert gloss] finish.

.2 EXT 5.3B: Alkyd [insert gloss] finish.

.3 EXT 5.3D: Wash primer/2 component aliphatic polyurethane [insert gloss] finish (high contact areas).

.4 EXT 5.3G: Water based light industrial coating [insert gloss] finish

3.4 INTERIOR SURFACES

.1 Paint interior surfaces in accordance with the MPI Manual painting systems listed in this section.

.2 Concrete Vertical Surfaces (including walls):

.1 INT 3.1A: Latex [insert gloss] finish.

.2 INT 3.1B: Latex aggregate [insert gloss] coating.

.3 INT 3.1C: High Performance Architectural Latex [insert gloss] finish.

.4 INT 3.1D: Alkyd [insert gloss] finish.

.5 INT 3.1H: Multicolor finish.

.3 Concrete Horizontal Surfaces (floors and stairs):

.1 NT 3.2A: Latex floor enamel finish.

.2 INT 3.2B: Alkyd floor enamel gloss finish.

.3 INT 3.2C: 2 component epoxy [insert gloss] finish.

.4 INT 3.2D: Pigmented 2 component polyurethane finish.

.5 INT 3.2E: Concrete stain finish.

.6 INT 3.2F: Concrete floor sealer, solvent based.

.7 INT 3.2G: Waterborne concrete floor sealer.

.8 INT 3.2H: Latex zone/traffic marking finish (for parking lines, etcetera).

.4 Concrete Masonry Units (smooth and split face block and brick):

.1 INT 4.2A: Latex [insert gloss] finish.

.2 INT 4.2B: Latex aggregate [insert gloss] coating.

.3 INT 4.2C: Alkyd [insert gloss] finish.

.4 INT 4.2D: High Performance Architectural Latex [insert gloss] coating.

.5 INT 4.2H: Multicolor finish.

.6 INT 4.2K: Water based light industrial coating [insert gloss] finish.

.5 Structural Steel and Metal Fabrications:

.1 INT 5.1A: Quick dry [insert gloss] finish.

.2 INT 5.1B: Water based light industrial coating [insert gloss] finish.

.3 INT 5.1C: Waterborne dry fall finish.

.4 INT 5.1D: Alkyd dry fall finish.

.5 INT 5.1E: Alkyd [insert gloss] finish.

.6 INT 5.1M: Aluminum paint finish.

.6 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etcetera):

.1 INT 5.3A: Latex [insert gloss] finish.

.2 INT 5.3B: Water based light industrial coating [insert gloss] finish.

.3 INT 5.3C: Alkyd [insert gloss] finish.

.4 INT 5.3F: Alkyd dry fall finish (for low contact/traffic areas only).

.5 INT 5.3G: Aluminum paint finish.

.6 INT 5.3H: Waterborne Dry Fall (for low contact / traffic areas)

.7 INT 5.3J: Waterborne Primer / Latex [insert gloss] finish.

.8 INT 5.3K: Waterborne Primer / Water based light industrial coating [insert gloss] finish.

.9 INT 5.3L: Non Cementitious Primer / Alkyd [insert gloss] finish.

.7 Site Painting for Structural Steel: Interior acrylic polyurethane paint system:

.1 Structural Steel Members (Shop Primed).

.1 Shop Priming: Surface preparation to SSPC SP6. One coat of organic zinc-rich epoxy primer Zinc Clad III HS B69A100 Series by Sherwin-Williams at 125 um (5 mils) DFT.

.2 Site clean surface to SSPC SP2 or SP3. Touch up with shop primer.

.3 One coat of semi-gloss acrylic polyurethane Acrolon 218 HS B65-650 Series by Sherwin-Williams at 152 um (6 mils) DFT.

.2 Metal Deck.

.1 Surface preparation to SSPC SP1.

.2 One coat of water based wash primer DTM Wash Primer B71Y1 by Sherwin-Williams at (25 um (1 mil) DFT.

.3 One coat of semi-gloss acrylic polyurethane Acrolon 218 HS B65-650 Series by Sherwin-Williams at 152 um (6 mils) DFT.

3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Paint “unfinished” conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:

.1 In exposed-to-view exterior and interior areas.

.2 In interior high humidity interior areas.

.3 In boiler room, mechanical and electrical rooms.

.2 Leave conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks in unfinished areas.

.3 Paint inside of ductwork where visible behind louvers, grilles and diffusers beyond sight line with primer and one coat of matt black (non-reflecting) paint.

.4 Paint the inside of light valances gloss white.

.5 Refer to Mechanical and Electrical specifications for painting, banding, stencilling of other surfaces/equipment, and generally as follows:

.1 Paint gas piping gas standard yellow where visible in service spaces.

.2 Paint both sides and all edges of plywood backboards for equipment before installation.

.3 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.4 Do not paint over nameplates.

3.6 SITE QUALITY CONTROL

.1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 4’ from the painted surface:

.1 Runs, sags, hiding or shadowing by inefficient application methods

.2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles

.2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.

.1 Damage due to touching before paint is sufficiently dry or any other contributory cause.

.2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.

.3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)

.3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Owner or Consultant:

.1 Small, affected areas may be touched up

.2 Large, affected areas or areas without sufficient dry film thickness of paint shall be repainted.

.3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

3.7 PROTECTION

.1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.

.2 Curing periods shall exceed the manufacturers recommended minimum time requirements.

.3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.8 CLEANUP

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete all epoxy wall and ceiling coatings installation.

1.3 QUALITY ASSURANCE

.1 Qualifications: Execute work of this Section by applicators approved by epoxy coating manufacturer having proven record of satisfactory installations similar to that specified and with proper equipment and skilled workers to perform it expeditiously. If requested, submit proof of these qualifications.

.2 Regulatory Requirements: Fire Hazard Classification as determined by ULC testing in accordance with ULC S102 shall not exceed following: Flame Spread 25.

.3 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper procedures and schedules for maintaining the work.

.4 Sample Installation: At Site, in area designated by Consultant provide sample installation for each type and colour of coating, including primer, block filler and necessary number of coats to obtain specified finish, showing colour, bond and quality of work. Modify sample installations to obtain approval. Do not proceed with work until sample installations have been approved. Approved sample installations shall become standard of comparison for work of this Section and may form part of the Work.

.5 Pre-Installation Meeting: Prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review procedures to be adopted, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.6 Manufacturer’s Site Inspection: Have the manufacturer’s technical representative inspect the work at suitable intervals during application and at conclusion of the work of this Section, to ensure the work is correctly installed. When requested, submit manufacturer’s inspection reports and verification that the work of this Section is correctly installed.

.7 Testing of Substrate: Test substrate after preparation for Product installation is complete and filler, patching or levelling compound is fully cured. Conduct testing on substrate free of sealer, oil, grease and other agents detrimental to the test and the installation of the Products. Locate test sites to cover representative installation areas. Do not proceed with work when the test results do not conform to the specified allowable.

.1 Concrete Wall Cohesive Strength: Minimum 1.5 MPa (210 psi) by tensile load as tested to CSA A23.2-6B. Do one test for every 1000 sq.ft. or fraction thereof.

.2 Moisture Vapour Transmission: ASTM D4263 plastic sheet method, no visible condensation or vapour allowed. Do one test for every 500 sq.ft. or fraction thereof.

.3 Surface Moisture Content: Maximum 4%, tested by moisture meter. Do one test for every 500 sq.ft. or fraction thereof.

.4 Surface Temperature: Minimum 3 deg C above the measured dew point.

1.4 SUBMITTALS

.1 Samples for Verification: Provide 305 mm x 305 mm (12" x 12") samples of each type of epoxy coating on representative substrate showing stages of application. Submit additional samples until approval is obtained. Make corrections to mix as required to secure correct colour and texture. Label sample(s) with Project name and number, applicator, names of material and manufacturer, area where material will be applied, date of sample, colour, texture and mix proportion.

.2 Maintenance Data: Provide specific instructions for maintenance, preservation, cleaning and adequate warning of maintenance practices or materials detrimental to finish surfaces.

1.5 DELIVERY, STORAGE, HANDLING & PROTECTION

.1 Deliver materials to Site in original unopened containers with manufacturer's labels and seals intact. Labels shall identify manufacturer's name, brand name of products, grade and type, application directions and shelf life or expiry date of product.

.2 Handle and store materials in accordance with manufacturer's printed directions. Store in warm, dry, lockable area until surfaces are ready for application.

.3 Prior to mixing, store components at temperature between 10 deg C and 32 deg C (50 deg F and 90 deg F) for minimum 24 hours before use.

.4 Store flammable materials in safe, approved containers to eliminate fire hazards. Remove from Site at end of each work shift.

.5 Do not use materials that has been stored for period of time exceeding maximum recommended shelf life of materials.

1.6 SITE CONDITIONS

.1 Do not apply coatings over substrate materials that contain over 3% moisture. Obtain approval of coating manufacturer of moisture content of substrate before proceeding with application.

.2 Maintain minimum surface temperatures at 10 deg C (50 deg F) for 24 hours before, during, and for 48 hours following application, or until cured.

.3 Maintain well-lit, dust-free and well-ventilated area.

.4 Comply with coating manufacturer's directions for maintenance of substrate temperatures, ventilation and other conditions required to execute and protect work.

.5 Allow new concrete substrate to cure for minimum of 28 days.

1.7 PROTECTION

.1 Protect adjacent surfaces not scheduled to receive coatings from damage and overspray resulting from work of this Section. If necessary, cover or mask surfaces adjacent surfaces to those receiving coating including fixtures and equipment.

.2 Replace at no extra cost, materials soiled by coatings during application and storage, and from which spillage cannot be completely removed.

.3 Erect barriers to prevent entry and presence of workers not performing work of this Section during application of coating and for 48 hours following completion of application.

1.8 WARRANTY

.1 Warrant work of this Section against defects and deficiencies for period of five (5) years commencing on Substantial Performance. Promptly correct defects to satisfaction of and at no expense to Owner. Defects shall include, but not be limited to, crazing, blistering, fading, bond failure and softening. Damage due to structural failure of base, surface, water seepage or abnormal abuse is exempted from warranty.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar epoxy coating systems may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Sika Canada

.2 Neogard

2.2 MATERIALS – EPOXY FLOOR COATING

.1 Diesel Exhaust Fluid Storage Area:

.1 Two-component, solvent-free and low-VOC containing, epoxy binder and coating, providing extremely high chemical and mechanical resistance with a broadcast floor finish.

.2 Broadcast Finish: Three-coat application of prime coat, broadcast coat and top coat. Colour: As selected from Manufacturer's full product line.

.1 Basis of Design Material: Sikafloor Fastflor CR by Sika Canada.

.2 Equipment Storage and Equipment Room Areas:

.1 Solid colour, high gloss, textured, resin-rich, aggregate-filled, seamless, epoxy-based floor coating. Thickness range of 2 - 3 mm (80 – 120 mils).

.2 Broadcast Finish: Three-coat application of prime coat, broadcast coat and top coat. Colour: As selected from Manufacturer's full product line.

.1 Basis of Design Material: Sikafloor Morritex Broadcast System by Sika Canada.

.3 Garbage Bin Storage; Bus Wash, Service and By Pass Lanes:

.1 Two-component, 100 % solids, flexible, urethane modified epoxy resin, designed as binder for fast setting, skid resistant concrete overlays.

.2 Full Broadcast Finish: Three-coat application of base coat complete with broadcast, and two grout coats. Colour: As selected from Manufacturer's full product line.

.1 Basis of Design Material: Sikalastic Duochem 8200 CR by Sika Canada.

2.3 MATERIALS – EPOXY WALL COATING

.1 Primer and Concrete Block Filler – Concrete Surfaces: Two-component, high performance primer and filler, low odour and low VOC; Colour:

.1 Colour: Off-white.

.2 Basis of Design Material: Sikaguard Duroplast EE by Sika Canada.

.2 Epoxy Wall Coating:

.1 Colour: As selected from manufacturer's full product line.

.2 Base Coat: Two-part, high solids, low odour, low VOC, finely textured, glossy, pigmented coating.

.1 Basis of Design Material: Sikaguard Duroplast 100 N by Sika Canada.

.3 Top Coat: High solids, two-component, low odour, low VOC, water-based epoxy coating.

.1 Basis of Design Material: Sikaguard Duroplast 150 by Sika Canada.

2.4 MATERIALS – EPOXY CEILING COATING

.1 Primer: Two-component, high performance primer and filler, low odour and low VOC; Colour:

.1 Colour: Off-white.

.2 Basis of Design Material: Sikaguard Duroplast EE by Sika Canada.

.2 Epoxy Ceiling Coating:

.1 Colour: As selected from manufacturer's full product line.

.2 Finish Coat: High solids, two-component, low odour, low VOC, water-based epoxy coating.

.1 Basis of Design Material: Sikaguard Duroplast 150 by Sika Canada.

2.5 ACCESSORIES

.1 Sealant: Multi-component type, CAN/CGSB-19.24-M, or 1 component polysulphide type, CAN/CGSB-19.13-M. Standard colour.

.2 Backer Rod: Polyethylene, urethane, neoprene or vinyl closed cell, foam rope with Shore "A" hardness of 20 and tensile strength between 140 and 200 kPa.

3 Execution

3.1 EXAMINATION

.1 Ensure surfaces to be coated are sound, clean, non-dusting, cured, free from oil and efflorescence and any other contaminants.

.2 Report immediately defects and unsatisfactory conditions. Commencement of work shall imply acceptance of existing conditions.

.3 Ensure surface temperature and moisture content of substrate meet minimum environmental requirements outlined herein.

3.2 PREPARATION

.1 Prepare existing or new surfaces and apply primer to substrate as per manufacturer's recommendations.

.2 Mix coatings in accordance with manufacturer's directions.

3.3 APPLICATION

.1 Apply work of this Section before adjacent work is painted.

.2 Do not apply coating over non-hardening sealants or caulking materials

.3 Block Filler and Patching Compound: Apply at a thickness to ensure complete coverage with pores and cracks filled.

.4 Apply coatings in accordance with manufacturer's instructions to produce monolithic wearing surface of minimum DFT indicated to even, uniform in colour and appearance, free from marks, runs, craters or other defects detrimental to appearance or performance. Match approved samples.

.5 Broadcast aggregate into wet floor coatings to refusal. Remove excess aggregate prior to applying finish coats, as recommended by the manufacturer.

.6 Allow proper cure time between coats as recommended by manufacturer. Protect surface from damage during this time.

.7 Provide water-tight seal to all pipes and projections coming through wall coating, using sealant.

.8 Do not apply wall coatings over sealed control and expansion joints. Advise other Sections in advance of sealant application until wall coating system is cured.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All work shall conform to the local Municipal Specifications where conflicts exist. Applicable CSA standards will prevail where ANSI or ASTM conflict with CSA standards.

1.2 SECTION INCLUDES

.1 Traffic control signs complying with local provincial transportation standards and as specified. See Construction Drawings for type, location, and quantity of signs required.

1.3 REFERENCES

.1 Refer to local municipalities traffic regulations and standards.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Submit fully dimensional shop drawings to Consultant showing construction, assembly, elevations, sections and interfacing with work of other Sections.

.2 No work of this Section shall be fabricated until shop drawings and all other related submittals, documentation, certifications and samples as required by this Section, have been reviewed by Consultant.

.3 Details shall indicate metal thicknesses, fasteners and welds, all anchorage assemblies and components and erection details.

.2 Submit necessary templates and instructions where supports, anchors or services have to be built-in by others.

1.5 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store materials in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Unsatisfactory materials shall be removed from the Site.

.5 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of this Section.

.6 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

2 Products

2.1 ACCEPTABLE MANUFACTURER

.1 As approved by local Municipality.

2.2 SIGNS

.1 "STOP" Signs.

.2 "SPEED LIMIT 15" Signs.

.3 "NO PARKING, FIRE LANE" Signs.

.4 "KEEP RIGHT" Signs.

.5 "DO NOT ENTER" Signs.

.6 "YIELD" Signs.

.7 "RIGHT TURN ONLY" Signs.

.8 "LEFT TURN ONLY" Signs.

.9 "NO TRUCKS" Signs.

.10 Miscellaneous Signs - See Contract Documents.

2.3 POSTS

.1 Round, galvanized posts with galvanized sign-mounting hardware for each sign, or as otherwise specified.

3 Execution

3.1 INSTALLATION

.1 Install posts in 18" (450mm) round x 4'-0" (1.2m) deep concrete foundations. Set posts vertical and plumb with bottom of sign at 6'-6" (2.0m) above finished grade.

.2 Mount signs in accordance with manufacturer's written instructions.

3.2 CLEANING AND ADJUSTING

.1 Upon completion of the work of this Section, or when directed by Consultant, remove all protective coatings and coverings. Clean and polish all exposed surfaces.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of:

.1 Washroom and custodial accessories,

.2 Framed mirrors, and

.3 Attachment hardware.

.2 Include all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

1.3 REFERENCES

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

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

.3 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.4 ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable

1.4 SUBMITTALS

.1 Provide submittals specified and as required to assess conformance with the Contract Documents, in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: For each product, indicate manufacturers and product name, including installation requirements and instructions.

.3 Shop Drawings: Show and describe in detail, materials, finishes, dimensions, details of connections and fastenings, elevations, plans, sections, metal gauges, hardware and any other pertinent information.

.1 Provide Professional Engineer stamped shop drawing for wall reinforcement of adult change table and grab bars.

.4 Coordinate the work of this Section with the placement of internal wall reinforcement.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store materials in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Unsatisfactory materials shall be removed from the site.

.5 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of the Section.

.6 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

1.6 ELECTRICAL CO-ORDINATION

.1 Electrical Requirements: Coordinate wiring requirements and power characteristics of work with building electrical system. Do wiring in strict conformity with requirements of the Electrical Code and Electrical Sections.

.1 Work by Electrical Sections: Supply and installation of disconnect switch/junction box and power to the disconnect switch/junction box.

.2 Work by This Section: Wiring and connection at and from disconnect switch/junction box to motors, starters, switches, controls, safety devices and other items requiring power.

.2 Employ licensed electrician to wire and interconnect all operational and safety components for the Work. Terminate wiring required for connection to control circuitry and power at NEMA enclosures. Ground all control wiring.

.3 Electrical Components, Devices, and Accessories: CSA certified and labelled.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests for substitution in accordance with Section 01 33 00 – Submittal Procedures.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 ASI Watrous - Global Partitions

.2 Bobrick

.3 Frost

.4 Koala Kare

.5 Dyson

2.2 MATERIALS

.1 Provide one of the products indicated for each designation in the Washroom and Custodial Accessory Schedule below, subject to compliance with specified requirements.

.2 Stainless Steel: In accordance with ASTM A666, Type 304, with No. 4 finish (satin); minimum nominal thickness as established by product type.

.3 Sheet Steel: Steel: In accordance with ASTM A1008/A1008M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pretreatment as required for applied finish.

.4 Galvanized Steel Sheet: In accordance with ASTM A653/A653M, minimum Z180 coating designation.

.5 Galvanized Steel Mounting Devices: In accordance with ASTM A153/A153M, hot dip galvanized after fabrication.

.6 Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

.7 [Emergency Call System: Refer to Section 08 70 00 for requirement.]

.8 Supply for installation under other Sections, mounting devices and reinforcement required to be built-in for support of grab bars, adult change table and imposed loads. Be responsible for giving proper notice to other Sections and supplying such reinforcement when required by other Sections for building in.

2.3 FABRICATION

.1 Washroom and Custodial Accessories:

.1 Surface Mounted:

.1 Fabricate units with tight seams and joints, and exposed edges rolled.

.2 Hang doors and access panels with continuous stainless steel hinge.

.3 Provide concealed anchorage where possible.

.2 Recessed Mounted:

.1 Fabricate units of all welded construction, without mitred corners.

.2 Hang doors and access panels with full length, stainless steel hinge.

.3 Provide anchorage that is fully concealed when unit is closed.

.2 Workmanship shall be best grade of modern shop practice known to recognized manufacturers specializing in this work. Joints and intersecting members shall be accurately fitted, made in true planes with adequate fastening. Wherever possible fastenings shall be concealed.

.3 Isolate where necessary to prevent electrolysis between dissimilar metal to metal or metal to masonry or concrete contact.

.4 Fabricate and erect work square, plumb, straight, true and accurately fitted. Provide adequate reinforcing and anchorage.

.5 Drilling shall be reamed and exposed edges left clean and smooth.

.6 Include anchors and fastenings necessary to anchor work of this Section.

.7 Coordinate with Section 06 10 00 – Rough Carpentry, for wood blocking for attachment of washroom accessories.

.8 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.

3 Execution

3.1 EXAMINATION

.1 Inspect surfaces over which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this Section. The decision regarding corrective measures shall be obtained from the Consultant prior to proceeding with the affected work.

.2 Commencement of work of this Section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Make thorough examination of drawings and details, determine the intent, extent, materials, conditions of interfacing with other work and be fully cognizant of requirements.

.2 Work of this Section shall include complete installation of items specified herein. Installation shall be in strict accordance with manufacturer's printed instructions.

.3 Securely fasten accessories, level and plumb in the locations shown on the drawings and specified herein. All fastenings shall be concealed.

.4 Co-ordinate the work of this Section with the work of other Sections to provide the necessary recesses, edge conditions wood blocking for the accessories as required.

.5 Do all drilling of steel, masonry and concrete necessary for the anchorage of the work.

.6 Installed grab bars shall be capable of supporting a downward pull of 2.22 kN (500 lbf).

.7 Install adult change table capable to carry minimum load of 1.33 kN (300 lbf).

3.3 ADJUSTING

.1 Check mechanisms, hinges, locks and latches, adjust and lubricate to ensure that accessories are in perfect working order.

3.4 CLEANING

.1 Upon completion of the work of this Section or when directed by Consultant, remove all protective coatings, and coverings. Clean and polish exposed surfaces.

3.5 WASHROOM AND CUSTODIAL ACCESSORY SCHEDULE

Code	Description	Model
CH1	Coat Hooks for Toilet Stalls: Satin finished stainless steel, square profiled robe hook with concealed mounting, provide 2 for each washroom, located as directed by Consultant.	7340-S by ASI B-76717 by Bobrick
CH2	Coat Hooks for Change Rooms: Satin finished stainless steel, rectangular hook strip, 2mm thick, four stainless steel hooks snap down for safety, complete with tamper-resistant mounting screws. Unit 455mm wide x 140mm high x 20mm deep. Provide in change rooms, in locations indicated on the Drawings.	129 by ASI B-985 by Bobrick
FNDU	Feminine Napkin Dispenser Unit: Surface mounted, equipped for two (2) coin operation, napkin and tampon dispenser, stainless steel construction, handicap accessible.	0864 by ASI B-2800 x 2 by Bobrick 608-3 by Frost
FND	Feminine Napkin Disposal: Surface mounted, concealed fastening, self-closing disposal opening with leak proof plastic receptacle and 10 disposable liners for initial stocking purposes for each unit.	0852 by ASI B-270 by Bobrick 622 by Frost
GB1	Grab Bar – 610 mm long: 1.214mm (0.048") thickness; 610 mm (24") long x 38mm (1-1/2") diameter, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-24 by ASI B-6806.99 x 24 by Bobrick

Code	Description	Model
GB2	Grab Bar – 765 mm long: 1.214mm (0.048") thickness; 765mm (30") long x 38mm (1-1/4") diameter, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-30 by ASI B-6806.99 x 30 by Bobrick
GB3	Grab Bar: "L"-shape grab bar, 760mm (30") long x 760mm (30") high 38mm (1-1/2") diameter, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	Type 04 by ASI B-6898.99 by Bobrick
GB4	Swing Up Grab Bar: Swing up operation, 740mm (29") long x 32mm (1-1/4") diameter, stainless steel, concealed mounting, cap secured with vandal resistant set screws.	3414 by ASI B-4998 by Bobrick
GB5	Grab Bar – 300 mm long: Vertical mount, 1.214mm (0.048") thickness; 305mm (12") long x 38mm (1-1/4") diameter, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws.	3801-12 by ASI B-6806.99 x 12 by Bobrick
RPTD	Paper Towel Dispenser and Disposal: Surface mounted, handicap accessible, capable of holding 600 C-fold or 800 multi-fold or 1100 single-fold paper towels, with leak proof waste container.	64676-9 by ASI B-380349 by Bobrick 400C by Frost
MR1	Mirror (Tilt): Framed, 910mm (36") high x 460mm (18") wide, fixed tilt installation for barrier free access, mounted 1000mm (40") to bottom of frame.	0535-1836 by ASI B-293 x 1836 by Bobrick
MR2	Mirror (Flat): Framed, 910mm (36") high x 460mm (18") wide, fixed installation, mounted 1000mm (40") to bottom of frame.	0600-1836 by ASI B-290 x 1836 by Bobrick
MR3	Mirror (Flat) with Shelf: Framed, 910mm (36") high x 460mm (18") wide, fixed installation, mounted 1000mm (40") to bottom of frame.	0600-1836 by ASI B-166 x 1836 by Bobrick
TPD	Toilet Tissue Dispenser: Double roll, surface mounted, tissue dispenser with concealed mounting, stainless steel construction, bright polished finish with theft resistant spindles.	7305-2B-R009 by ASI B-686-60 by Bobrick
TPD2	Toilet Tissue & Seat-Cover Dispenser, and Napkin Disposal: Surface mounted, concealed fastening, self-closing disposal opening with leak proof plastic receptacle; Toilet-seat-cover disposal hold 500 paper covers, and double roll toilet tissue dispenser.	0842 by ASI B-3579 by Bobrick

Code	Description	Model
TSC	Seat-Cover Dispenser: Surface-mounted toilet seat cover disperser, concealed fastening, type 304, 20 gauge stainless steel, one-piece seamless construction. Capacity: 250 single fold paper covers.	0477-SM by ASI B-4221 by Bobrick
BCT	Baby Change Table: Surface mounted, horizontal design, prefabricated baby changing station with built-in sanitary liner dispenser and safety belt, complete with initial stocking supplies and stocking list for replacement stock.	9012 by ASI KB-200 by Koala Kare
SS	Shelf: Surface mounted shelf, 405mm (16”) long x 125mm (5”) wide, 18 gauge, type 304 stainless steel, satin finish. 19mm (3/4”) return front edge, hemmed.	0692-516 by ASI B-295 x 16 by Bobrick
[SS]	Shelf: Surface mounted shelf, 457mm (18”) long x 100mm (4”) wide, 18 gauge, type 304 stainless steel, satin finish, 13mm (1/2”) or 19mm (3/4”) return front edge, hemmed.	10-0692-418 by ASI MS-18 by Gamco
SD1	Counter-Mounted Soap Dispenser: All-purpose valve, horizontal mounting stainless steel surface mounted dispenser, refillable from top with keyed lock cap, 1.18 L capacity with visible viewing window.	0342 by ASI B-2112 x 2 by Bobrick 710A by Frost
SD2	Wall-Mounted Soap Dispenser: Heavy-duty all-purpose valve, wall-mounted stainless steel soap dispenser, 1.2L capacity with visible viewing window:	0347 by ASI B-2111 by Bobrick
JS	Janitor’s Shelf with Mop and Broom Holders and Hooks: 864mm (34") long x 330mm (13") high x 200mm (8") deep. Shelf constructed of minimum 18-8 stainless steel, type 304, 18 gauge. Utility hooks fabricated of 11 gauge stainless steel, and mop holders fabricated of cadmium plated steel. Pivoting, spring-loaded serrated rubber cam shall hold round handles of 22mm to 32mm (7/8" to 1-1/4") diameter	1308-3 by ASI B-239 x 34 by Bobrick
HD	Hand Dryer: High-speed hand dryer, surface mounted, touch free infra-red activation. Motor: 208 V, 60 Hz.	20200-2 Tri-Umph by ASI Air blade Hand Dryer by Dyson
SHC	Shower Curtain: Opaque, matte white vinyl, 0.2mm (.008") thick, containing antibacterial and flame-retardant agents. Complete with grommets every 150mm (6"), and hemmed top, bottom, and sides.	1200-V by ASI B-204-2 by Bobrick

Code	Description	Model
SHCH	Shower Curtain Hook: Fabricated of type 304 stainless steel alloy 18-8, solid formed wire 2.5mm (0.98") in diameter. Hook shall accommodate 25mm to 32mm (1" to 1-1/4") diameter curtain rods.	1200-SHU by ASI B-204-1 by Bobrick
SHCR	Shower Curtain Rod: Extra-heavy-duty rod, 32mm (1-1/4") diameter fabricated of alloy 18-8 stainless steel, type 304, 18 gauge. Flanges fabricated from 20-gauge stainless steel. Satin Finish. Length: As determined on the Drawings.	1204 by ASI B-6047 by Bobrick
SHSD	Shower Soap Dish: Type 304 stainless steel, matte polished finish. Mounting clamp for stud walls. Unit 7 3⁄16" W, 5" H (185 x 125mm). Rough Wall Opening: 6" W, 4" H, 4" min. depth (150 x 100 x 100mm).	7404 by ASI B-4380 by Bobrick
SHS	Shower Seat: Constructed of durable, water-resistant, ivory colored, 5⁄16" (8mm) thick solid phenolic. Frame and mounting bracket are Type 304 stainless steel and self-locking mechanism. Supports up to 500 lbs. (227 kg) when properly installed. Seat 22" (560mm) wide, projects 15 13⁄16" (400mm) from wall.	8203 by ASI B-5192 by Bobrick
[ ]	Adult Change Table: Wall mounted, electrically powered height adjustable from [300 mm to 1000 mm (12” to 39”)] [701 mm (27.6”)] height adjustment, weight capacity of [200 kg (441 lb)], upwards speed 15 mm/s (0.03 mph), downwards speed 20 mm/s, wired hand control.	**SPEC NOTE: Check the size. The following were previously specified:** [SCT 1000, R8593118000 by Pressalit] [SCT 3000, R8592318301 in Graphite Gray by Pressalit] [SCT 3000, R8592318299 in Sapphire Blue by Pressalit]
[ ]	Wall Reinforcement: HSS steel and steel plates within wall assembly to accommodate future installation of adult change table. Provide Professional Engineer stamped shop drawing for wall reinforcement to support basis-of-design product no. [R8593118000 (70.9” table length option) by Pressalit].	

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 84 00 – Firestopping

.2 Section 09 22 16 – Non-Structural Metal Framing

1.2 REFERENCE STANDARDS

.1 National Fire Protection Association (NFPA):

.1 NFPA 10-2013, Standard for Portable Fire Extinguishers

.2 ULC Standards (ULC):

.1 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems

.2 CAN/ULC-S503-05, Standard for Carbon-Dioxide Fire Extinguishers

.3 CAN/ULC-S504-2, Standard for Dry Chemical Fire Extinguishers

.4 CAN/ULC-S507-05, Standard for Water Fire Extinguishers

.5 CAN/ULC-S508-02, Standard for the Rating and Fire Testing of Fire Extinguishers

.6 CAN/ULC-S532-2014, Standard for the Regulation of the Servicing of Portable Fire Extinguishers

.7 CAN/ULC-S554:2016, Standard for Water Based Agent Fire Extinguishers

.8 CAN/ULC-S566:2017, Standard for Halocarbon Clean Agent Fire Extinguishers

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: Hold a meeting in accordance with Section 01 31 19 – Project Meetings with Contractor, impacted Subcontractors, and representative of consultant to discuss locations and exact mounting heights of extinguisher cabinets to minimize cutting of wall tile, align with nearby wall mounted equipment.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit manufacturer's product literature and data sheets. Include product characteristics, performance criteria, listed temperature range, dimensions, colours, finishes, and limitations.

.1 Portable fire extinguishers: Indicate capacity.

.3 Shop Drawings: Submit schedule of portable fire extinguisher types, extinguisher cabinet types, finishes, accessories, and dimension from finished floor to top of portable fire extinguisher for each room/area.

.4 Manufacturers' Instructions: Submit manufacturer's installation instructions, special handling criteria, and recommendations for owner's regular inspection and testing of portable fire extinguishers.

.5 Qualification Statements: When requested submit evidence of installer's qualifications.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals, and as follows:

.1 Operation and Maintenance Data: Submit portable fire extinguisher manufacturer's instruction manual describing installation, operation, inspection, and maintenance; refill or recharge schedules; and re-certification requirements.

.2 Submit a permanent file record in accordance with NFPA 10 for each portable fire extinguisher with the following information:

.1 Maintenance date and name of person and agency performing the maintenance, if applicable.

.2 Date of the last recharge and name of person and agency performing the recharge, if applicable.

.3 Hydrostatic retest date and name of person and agency performing the hydrostatic test, if applicable.

.4 Description of dents remaining after passing of the hydrostatic test, if applicable.

.2 Warranty Documentation: Submit manufacturer's warranties.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Space Parts: Supply one extra key for each type of lockable extinguisher cabinet. Label keys with the associated room identification number.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide all extinguisher cabinets of the same type from a single manufacturer.

.2 Installer: Holding an approval certificate of training from a public post-secondary educational institution and employed by an agency that is certified annually by a recognized certification body as being compliant with CAN/ULC-S532.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 – Common Product Requirements, and as follows:

.1 Package and handle extinguisher cabinets to avoid scratching paint and glazed materials. Store extinguisher cabinets to avoid corrosion and portable fire extinguishers to avoid freezing.

.2 Maintain portable fire extinguishers in operating condition.

1.9 SITE CONDITIONS

.1 Ambient Conditions: Install portable fire extinguishers after indoor temperatures are maintained within manufacturer's recommended range.

1.10 WARRANTY

.1 Manufacturer's Warranty: Warranty portable fire extinguishers against defects in materials and fabrication for three years.

2 Products

2.1 DESCRIPTION

.1 Regulatory Requirements: Provide portable fire extinguishers that are listed and labelled in accordance with National Fire Code 2020 and conform to CAN/ULC-S508.

.2 Portable fire extinguishers and extinguisher cabinets marked in accordance with recommendations of NFPA 10 and CAN/ULC-S508 including the following:

.1 Listing and labeling organization of extinguisher.

.2 Protect category, type of extinguisher.

.3 Extinguisher classification.

.4 Performance and fire test standards of extinguisher.

2.2 PORTABLE FIRE EXTINGUISHERS

.1 Multi-Purpose Dry Chemical Extinguishers: To CAN/ULC-S504, Rechargeable type, with hose and shut-off nozzle, brass valve, ULC listed.

.1 ULC Classification: Class A, B, and C fires.

.2 Capacity:4.5kg

.3 Cylinder Finish: Polyester powder coat paint, red colour.

.4 Heavy duty mounting bracket, powder-coated steel construction.

3 Execution

3.1 INSTALLATION

.1 Install extinguisher cabinet brackets plumb, level, and in accordance with NFPA 10.

.2 Mount portable fire extinguishers on brackets and locations indicated on Drawings and in accordance with NFPA 10.

.1 Place portable fire extinguisher with operating instruction label facing outward. Do not obstruct the view of the operating instructions label with maintenance labels, test labels, or other labels.

3.2 CLEANING

.1 Perform in accordance with Section 01 74 00 – Cleaning.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply and install the following miscellaneous specialties as specified herein, including all associated supports, fasteners and accessories required to provide a complete installation.

1.2 QUALITY ASSURANCE

.1 Installer: Trained and approved by the manufacturer and having a minimum three years experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.

.2 Maintenance Seminars: Engage a factory authorized service representative to train Owner's maintenance personnel on proper maintenance procedures.

.3 If requested by the Consultant, submit names of projects with locations, names of owner and consultant where the Product to be used has been used previously and performed satisfactorily, date it was installed, and size of installation.

.4 Pre-Installation Meetings: Prior to commencing Work of this Section, arrange for each respective manufacturer's technical representative to review with the Contractor and Consultant procedures to be adopted, conditions under which the Work will be done, and inspect the surfaces to receive the Product, in order that any alternate recommendations may be made should adverse conditions exist.

1.3 DESIGN REQUIREMENTS

.1 Design work to withstand within acceptable deflection limitations their own weight, and minimum design loads due to pressure and suction of wind as calculated in accordance with the governing building code and other requirements of authorities having jurisdiction.

.2 Acceptance deflection limit for each member shall be maximum 1/175 within a 600 mm (24") span, non-accumulative.

1.4 SUBMITTALS

1. Shop Drawings: Indicate sizes and finishes in elevation, jointing details and caulking, cuts and drilled holes, anchorage and securement systems, interfaces with the Work of other Sections, material identification, thicknesses, and gauges.
    1. Shop Drawing Showing Structural Component: Bearing the signature and seal of a professional engineer responsible for the engineering design of the work.
2. Samples: When requested submit full size samples of all Products.
3. Maintenance Instructions: Submit maintenance instructions that specify warnings of any maintenance practice or materials which may damage or disfigure each Product. Include operating instructions.
4. Signage Layout Drawings: Submit full-size layouts to Consultant for review before fabrication is initiated, show layouts including positions of all messages, lines, arrows, and other symbols.

1.5 ELECTRICAL CO-ORDINATION

.1 Electrical Requirements: Coordinate wiring requirements and power characteristics of work with building electrical system. Do wiring in strict conformity with requirements of the Electrical Code and Electrical Sections.

.1 Work by Electrical Sections: Supply and installation of disconnect switch/junction box and power to the disconnect switch/junction box.

.2 Work by This Section: Wiring and connection at and from disconnect switch/junction box to motors, starters, switches, controls, safety devices and other items requiring power.

.2 Employ licensed electrician to wire and interconnect all operational and safety components for the Work. Terminate wiring required for connection to control circuitry and power at NEMA enclosures. Ground all control wiring.

.3 Electrical Components, Devices, and Accessories: CSA certified and labelled.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Package or crate, and brace products to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

2 Products

2.1 MANUFACTURERS

.1 Specified Products: Work of this Section is based on specified products. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant’s acceptance.

2.2 MATERIALS

.1 Exposed Metal Fastenings and Accessories: Of same material, texture, colour and finish as the base metal to which they are applied or fastened, unless otherwise specified.

.2 Provide reinforcing, fastenings, and anchorage required for building in.

.3 Do not attach manufacturer's name or trademark, plates, imprints or labels to products unless approved by Consultant.

2.3 FABRICATION

.1 Verify site dimensions prior to fabrication. Fabricate work true to dimensions and square. Finished work shall be free from distortion and defects detrimental to appearance and performance.

.2 Accurately fit joints and intersecting members in true planes with adequate fastening.

.3 Fit and assemble Products in shop where possible. Execute according to details and reviewed shop drawings. Where shop fabrication is not possible, make trial assembly in shop.

2.4 COLUMN PROTECTOR COVERS

.1 Linear low density polyethylene formed cover, formed to size to tie fit around steel metal columns Column Sentry FIT Series by Sentry Protection Products.

.1 Provide covers to match designed column sizes and shapes.

3 Execution

3.1 EXAMINATION

.1 Examine substrate surfaces to receive the Work of this Section and ensure that work done as part of the Work of other Sections is complete and that there are no conditions which will adversely affect the performance of this Work.

.2 Do not proceed with work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Install work in accordance with manufacturers' installation instructions. Ensure proper operation.

.2 Erect Work true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.

.3 Provide adequate reinforcing and anchorage to ensure a rigid installation.

.4 Securely fasten and tie components.

.5 Isolate between dissimilar metals, and metal and incompatible materials to prevent electrolysis with bituminous paint or other approved means.

.6 Co-ordinate installation with the work of Sections providing adjacent construction as required.

.7 Execute electrical work by qualified electricians and in compliance with the Canadian Electrical Code and other requirements of authorities having jurisdiction.

3.3 ADJUSTMENT

.1 Upon completion of the work or when directed, remove all traces of protective coatings or paper.

.2 Test operation, adjust, lubricate and ensure that accessories are in perfect working order.

3.4 PROTECTION

.1 Promptly upon completion of work and following preliminary review by the Consultant, cover finished products and protect exposed corners and areas vulnerable to damage by persons or by the movement of materials, tools or equipment.

.2 Maintain protective coverings in good order until the Consultant instructs that they be removed.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 QUALITY CONTROL

.1 Installer Qualification: Trained and approved by the manufacturer and having a minimum three years' experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type. If requested, provide letter of certification from manufacturer stating that installer is certified applicator of its products, and is familiar with proper procedures and installation requirements required by the manufacturer.

.2 Maintenance Seminars: Provide, to the Owner, training seminars and recommendations on Product maintenance procedures.

.3 Pre-Installation Meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.

.4 Manufacturer's Site Inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. When requested, submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.

.5 Source Limitations: Obtain each type of product from a single manufacturer.

1.3 SUBMITTALS

.1 Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

.1 Wiring Diagrams: Power, signal, and control wiring.

.2 Closeout Submittals: Complete description and sequence of operation together with wiring diagrams showing electrical connections, manufacturer's instructions covering maintenance requirements, and parts catalogue giving complete list of repair and replacement parts with cuts and identifying numbers.

1.4 ELECTRICAL CO-ORDINATION

.1 Electrical Requirements: Coordinate wiring requirements and power characteristics of work with building electrical system. Do wiring in strict conformity with requirements of the Electrical Code and Electrical Sections.

.1 Work by Electrical Sections: Supply and installation of disconnect switch/junction box and power to the disconnect switch/junction box.

.2 Work by this Section: Wiring and connection at and from the disconnect switch/junction box to motors, starters, switches, controls, safety devices and other items requiring power from the disconnect switch/junction box.

.2 Employ licensed electrician to wire and interconnect all operational and safety components for the Work. Terminate wiring required for connection to control circuitry and power at NEMA enclosures. Ground all control wiring.

.3 Electrical Components, Devices, and Accessories: CSA Listed and labelled.

2 Products

2.1 MANUFACTURERS

.1 Specified Products: Work of this Section is based on Flex 18 Barrier Gate by Canadian Parking Equipment. Products by other manufacturers similar in function, design, performance, and construction complying with requirements of this Section may be incorporated into the Work subject to Consultant's acceptance.

2.2 TRAFFIC ARM

.1 Concrete Pad: To requirements of Division 3 Cast-in-Place Concrete Section.

.2 Motor Enclosure: Prefinished, welded construction, lockable steel cabinets; with minimum 250 watts thermostatically controlled heater.

.3 Motor: 120 VAC, single phase, 1/3 HP; auto/manual switch and on/off switch.

.4 Barrier Arm: aluminium gate arms in longest permissible length to suit application.

.5 Control: Card reader access with intercom communication system.

.6 Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, and loop detector designed to close gates and arms. Hold gate and arm open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator and traffic arm. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.

3 Execution

3.1 INSTALLATION

.1 Install work in accordance with manufacturer's instructions.

.2 Automatic Barrier Gates: Anchor cabinets to concrete bases with anchor bolts or expansion anchors and mount barrier-gate arms.

.3 Vehicle Loop Detectors: [Cut grooves in pavement and bury] [Bury] and seal wire loop at locations indicated on Drawings according to manufacturer's written instructions. Connect to parking control equipment operated by detector.

3.2 ADJUSTING AND CLEANING

.1 Adjust parking control equipment to operate smoothly, easily, and properly. Confirm that locks engage accurately and securely without forcing or binding.

.2 Lubricate hardware and other moving parts.

.3 After completing installation of exposed, factory-finished parking control equipment, inspect exposed finishes and repair damaged finishes.

.4 Remove barrier-gate arms during the construction period to prevent damage, and install them immediately before Substantial Completion.

END OF SECTION

1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, representative of consultant before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

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

.4 Operation instruction for systems and component.

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

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

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

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

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

.2 Equipment performance verification test results.

.3 Special performance data as specified.

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

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to representative of consultant for approval.

.2 Make changes as required and re-submit as directed by mechanical engineer representative.

.6 Additional data:

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

.7 As-built drawings:

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

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

.3 Submit to mechanical engineer representative for approval and make corrections as directed.

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

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

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

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

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

.4 Furnish one commercial quality grease gun, grease, and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to Construction Work Area in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect equipment and components from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Execution

2.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Agreements are acceptable installation in accordance with manufacturer's written instructions.

.1 Notify design consulting representative for visual inspection of substrate.

.2 Inform design consulting representative 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 mechanical engineer representative.

2.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Painting.

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

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

2.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

2.4 FIELD QUALITY CONTROL

.1 Construction Work Area Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and Quality Assurance and submit report as described in Part 1.1 -

Action and Informational Submittals.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in Part 1.1 – Action and Informational Submittals.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic Construction Work Area visits for inspection of product installation in accordance with manufacturer's instructions.

2.5 DEMONSTRATION

.1 Refer to 01 79 00 Demonstration and Testing

.2 MCM may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.3 Trial usage to apply to following equipment and systems:

.1 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting, and servicing of all systems and equipment during regular Work hours, prior to acceptance.

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

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

.6 Subcontractor shall record these demonstrations on video for future reference as per 01 79 00 1.6.

2.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

2.7 PROTECTION

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A126-04(2019), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 ANSI/AWWA C700-20, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.

.2 ANSI/AWWA C701-19, Standard for Cold Water Meters-Turbine Type for Customer Service.

.3 ANSI/AWWA C702-19, Standard for Cold Water Meters-Compound Type.

.3 CSA Group (CSA)

.1 CSA-B64 Series-21, Backflow Preventers and Vacuum Breakers.

.2 CSA B79-08, Commercial and Residential Drains and Cleanouts.

.3 CAN/CSA-B356-10(R2020), Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP).

.1 IPMVP

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2020 (NPC).

.6 Plumbing and Drainage Institute (PDI)

.1 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with mechanical consultant representative in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.2 Submit copy of WHMIS SDS in accordance with Section 01 35 29.14 - Health and Safety Requirements for Contaminated Sites and 01 35 43 - Environmental Procedures. Indicate VOC's:

.3 Shop Drawings:

.1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction, and assembly details and accessories.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year, and capacity.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains -Watts FD-100-C-A. Epoxy coated cast iron, adjustable round 6mm thick top, anchor flange, trap primer tapping, reversible membrane clamp, collar with primary and secondary weepholes, ASME A112.21 M compliance.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze square or round cover with flush head securing screws, bevelled edge frame completes with anchoring lugs.

.2 Floor Access: rectangular cast iron body and frame with adjustable secured nickel bronze top or cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron round or square, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 NON-FREEZE WALL HYDRANTS

.1 Watts HY-725. Surface mount with integral vacuum breaker, NPS ¾ hose outlet, integral vacuum breaker, nickel bronze box and door, seat casting, bronze wall casing, chrome-plated hydrant face, loose key.

2.4 WATER HAMMER ARRESTORS

.1 Stainless steel construction, bellows type: to PDI-WH201.

2.5 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, application as indicated, reduced pressure principal type.

2.6 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric.

2.7 PRESSURE REGULATORS

.1 Capacity: as indicated.

.1 Inlet pressure: 1034 kPa.

.2 Outlet pressure: 448 kPa.

.2 Up to NPS 1-1/2 bronze bodies, screwed: to ASTM B62.

.3 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.

.4 Semi-steel spring chambers with bronze trim.

2.8 BACKWATER VALVES

.1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.

.2 Access:

.1 Surface access.

.2 Access pipe with cover: maximum 300 mm depth.

.3 Steel housing with gasketed steel cover.

.4 Concrete access pit with cover, as indicated.

2.9 HOSE BIBBS (INDOOR)

.1 Brass casing, bronze interior parts, rough brass finish, 19mm connection, 19mm hose connection, external vacuum breaker, removable black wheel handle.

2.10 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer pressure gauge on inlet and outlet, pressure reducing valve to CAN/CSA-B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

2.11 TRAP SEAL PRIMERS

.1 Jay R. Smith electronic trap priming device 270 SM. Surface mount, consisting of enclosure with cover, a solenoid valve, vacuum breaker, a timer and a manifold with multiple compression discharge ports.

.2 Brass, NPS 13mm (½") NPTF inlet, NPS 13mm(1/2") drip line connection.

2.12 STRAINERS

.1 860 kPa, Y type with twenty mesh, Monel, bronze, or stainless-steel removable screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.13 DIELECTRIC UNIONS

.1 Use dielectric unions for any transitions in piping materials.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Agreements are acceptable for plumbing specialities and accessories installation in accordance with manufacturer's written instructions.

.1 Notify mechanical consultant representative for visual inspection of substrate.

.2 Inform representative of 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 the mechanical consultant representative.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada (NPC), Good Practice for Northern Facilities guidelines and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 NON-FREEZE WALL HYDRANTS

.1 Install 600 mm above finished grade and as indicated.

3.6 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.7 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.1 Drains.

.2 Backwater Valves.

.3 Water Make-up Assembly.

.4 Grease Interceptors.

.2 Pipe discharge to terminate over nearest drain or service sink.

3.8 BACKWATER VALVES

.1 Install in main sewer lines, where indicated and at weeping tile connection in pit provided at building cleanout.

.2 Install in access pit as indicated.

3.9 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.10 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of the mechanical consultant representative.

.3 Install soft copper or plastic tubing to floor drain.

3.11 STRAINERS

.1 Install with sufficient room to remove basket for maintenance.

3.12 WATER MAKE-UP ASSEMBLY

.1 Install on valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.13 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.14 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, Section 23 05 93 - Testing Adjusting and Balancing of HVAC supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.7 Access doors:

.1 Verify size and location relative to items to be accessed.

.8 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.9 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.10 Wall, ground hydrants:

.1 Verify complete drainage, freeze protection.

.2 Verify operation of vacuum breakers.

.11 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.12 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.13 Hose bibbs, sediment faucets:

.1 Verify that flow and pressure meet design criteria.

.2 Check for leaks, replace compression washer if required.

.14 Hydronic system water Make-up Assembly:

.1 Verify flow, pressure, and connection.

.15 Water meters:

.1 Verify location and accessibility.

.2 Test metre reading accuracy.

.16 Soap Dispensing Systems:

.1 Verify location and reach.

.2 Check for leaks.

3.15 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning Requirements: reports, supplemented as specified.

.2 Training: provide training in accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel, supplemented as specified.

3.16 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

3.17 PROTECTION

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

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 07 92 00 – Joint Sealing.

.4 Section 22 07 19– Plumbing Piping Insulation.

.5 Section 23 05 53– Mechanical Identification for HVAC Piping and Equipment.

1.3 REFERENCES

.1 National Energy Code of Canada for Buildings 2020

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C335/C335M-23, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.3 ASTM C547-22a Standard Specification for Mineral Fibre Pipe Insulation.

.4 ASTM C795-08(2023), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.5 ASTM D1784-20, Standard Classification System and Basis for Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

.3 Canadian General Standards Board (CGSB)

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

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

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

.1 Material Safety Data Sheets.

.5 Manufacturer's Trade Associations

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

.6 Underwriters' Laboratories of Canada (ULC)

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

1.4 DEFINITIONS

.1 For purposes of this section:

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

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.2 TIAC ss:

.1 CRF: Commercial Rectangular Finish

.2 CPF: Commercial Piping Finish.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions to Owner.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: certified in performing work of this Section and have at least 5 years successful experience in this size and type of project, qualified to standards of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling, and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Owner.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Owner.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

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

.3 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C533.

.2 Maximum "k" factor: to 0.075 W/m °C @ 500° C.

.3 Design to permit periodic removal and re-installation.

.4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.

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

.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code A-6: Flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket to ASTM C534.

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

.3 Maximum "k" factor: 0.039 W/m – ^{o}C.

.4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

.5 Flame spread index less than 25, and smoke developed index less than 50.

.6 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.

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

.3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint. Confirm colour with Owner.

.3 Minimum service temperatures: -20^{o} C.

.4 Maximum service temperature: 65^{o} C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Thickness: 0.55 mm.

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Indoor: flame spread rating 25, smoke developed rating 50.

.2 Outdoor: UV rated material at least 0.5 mm thick.

.2 Aluminum:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Embossed or corrugated.

.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealing.

3 Execution

3.1 MANUFACTURE'S INSTRUCTIONS

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

3.2 PRE- INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

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

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

.1 See Section 22 07 16 – Plumbing Equipment Insulation.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified. Insulate vent pipes 3.0 m from roof penetration.

.2 TIAC Code: A-1.

.1 Securements: Tape at 300 mm on centre.

.2 Seals: Lap seal adhesive, lagging adhesive.

.3 TIAC Code: A-2.

.1 Insulation securements: 18 ga SS wire or 12 mm x 0.51 mm SS bands at 300 mm oc.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H.

.4 TIAC Code: A-3.

.1 Securements: Tape at 300 mm oc.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.5 TIAC Code: A-6.

.1 Insulation securements: as per manufacturer's recommendation.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-CA.

.6 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: 18 ga SS wire or 12 mm x 0.5 mm SS bands at 300 mm oc.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.7 Thickness of insulation to be as listed in following table.

.1 Run outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Table 6.2.3.1.
Minimum Thickness of Piping Insulation for Service Water Heating Systems
Forming Part of Sentences 6.2.3.1.(1) to (3), (5) and (6)

Location of Piping	Thermal Conductivity of Insulation		Nominal Pipe Diameter, mm (in.)	Minimum Thickness of Piping Insulation,(1) mm
	Conductivity Range, W/m×°C	Mean Rating Temperature, °C		
Conditioned space	0.035–0.040	38	Runouts(1) ≤ 51 (2)	25.4
			≤ 25.4 (1)	
			32 to 51 (1¼ to 2)	
			64 to 102 (2½ to 4)	38.1
			≥ 127 (5)	
Unconditioned space or outside	0.046–0.049	38	Runouts(1) ≤ 51 (2)	38.1
			≤ 25.4 (1)	63.5
			32 to 51 (1¼ to 2)	
			64 to 102 (2½ to 4)	76.2
			≥ 127 (5)	88.9

Application	**Temp °C**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**					
	Run out		**Run-out**	**to 1”**	**1 1/4 “to 2”**	**2 ½” to 4”**	**5 “to 6”**	**8” & over**
Domestic DHW/DHWR/ Tempered Water		A-1	25	25	25	38	38	38
Domestic DCW		A-3	25	25	25	25	25	25
Vent Pipe Plumbing		A-3	25	25	25	25	25	25

.8 Finishes:

.1 Exposed indoors: PVC jacket.

.2 Exposed in mechanical rooms: PVC jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: Water-proof Aluminium, or SS jacket.

.6 Finish attachments: SS screws or bands, at 150 mm oc. Seals: wing or closed.

.7 Installation: To appropriate TIAC code CPF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-18, Cast Cooper Alloy Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18-12, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-21, Wrought Copper, and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24-21, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ASME B16.26-18, Cast Copper Alloy Fittings for Flared Copper Tubes.

.6 ASME B31.9-20, Building Services Piping.

.7 ASME B36.19-22, Welded and Seamless Wrought Stainless-Steel Pipe (w/5/23 Errata).

.2 ASTM International (ASTM)

.1 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM A351/A351M-18e1, Castings, Austenitic, for Pressure Containing Parts.

.3 ASTM A536-84(2019), Standard Specification for Ductile Iron Castings.

.4 ASTM B32-20 Standard Specification for Solder Metal.

.5 ASTM B42-20, Seamless Copper Tube, Standard Sizes.

.6 ASTM B88-22, Standard Specification for Seamless Copper Water Tube.

.3 CSA Group (CSA)

.1 CSA B242-05(R2021), Groove and Shoulder Type Mechanical Pipe Couplings.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-14, Fire Endurance Tests of Buildings Construction and Materials.

.2 CAN/ULC S115-11(R2018), Standard Method of Fire Tests of Firestop.

.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

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

.1 Safety Data Sheets (SDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-70-2011, Grey Iron Gate Valves, Flanged and Threaded Ends.

.2 MSS-SP-71-2018, Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.3 MSS-SP-80-2019, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC) 2020.

.9 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data

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

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground:

.1 Copper tube, hard drawn, type K: to ASTM B88M.

.2 Buried or embedded:

.1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

.2 PEX Piping to CSAB137.5

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 250: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 50 mm (2”) and larger:

.1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

.2 PEX fittings to CSA B137.5 and F1960.

.6 NPS 38 mm (1 ½") and smaller:

.1 Cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

.1 Rubber gaskets, latex-free, 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head, and washers: to ASTM A307, heavy series.

.3 Solder: 95/5.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 50 mm (2") and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 65 mm (2 1/2") and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

.4 NPS 65 mm (2 1/2") and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.5 GLOBE VALVES

.1 NPS 50 mm (2") and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze.

.2 Lockshield handles as indicated.

.2 NPS 50 mm (2") and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 Lockshield handles as indicated.

2.6 BALL VALVES

.1 NPS 50 mm (2") and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 50 mm (2") and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 50 mm (2") and under, mechanical:

.1 To CSA B137.5 and ASTM F1960.

.2 Lead free brass body.

2.7 BUTTERFLY VALVES

.1 NPS 65 mm (2 1/2") and over, wafer.

.1 To MSS-SP-67, Class 200.

.2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.

.3 Lever operated.

.2 NPS 65 mm (2 1/2") and over, grooved ends:

.1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.

.2 Operator:

.1 NPS 4 and under: lever handle.

.2 NPS 6 and over: gear operated.

3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with NPC and local authority having jurisdiction.

.2 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.

.4 Install DCW piping below and away from DHW and DHWR and other hot piping to maintain temperature of cold water as low as possible.

.5 Insulate and jacket all domestic water piping in accordance with section 23 07 19 - HVAC Piping Insulation. All domestic water piping running outdoors shall be insulated with minimum 50mm thick insulation, SS 304 jacketing and heat tracing (as shown in Electrical and Mechanical Drawings).

.6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.7 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.8 Valves

.1 Isolate equipment, fixtures, and branches with ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa, whichever is larger.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Outlets shall be flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Verify that pressure booster systems are operating properly.

.4 Verify that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of MCM.

.2 Upon completion, provide laboratory test reports on water quality for mechanical consultant representative 's approval.

3.7 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and eliminate any air within the system.

.2 Check pressurization for proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring HWS storage tank up to design temperature slowly.

.4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Adjust pressure regulating valves while withdrawal is maximum, and inlet pressure is minimum.

.4 Sterilize HWS and HWC systems for Legionella control.

.5 Verify performance of temperature controls.

.6 Verify compliance with safety and health requirements.

.7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.8 Confirm water quality consistent with supply standards, and no residuals shall remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Division 01.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.9 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including cleaning and maintenance of specified materials and products with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

3.10 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International Inc.

.1 ASTM D2235-22: Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564-20, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-Series B1800-21, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

.2 CSA-B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.3 Green Seal Environmental Standards (GSES)

.1 Standard GS-36-13, Adhesives for Commercial Use.

.4 Underwriters Laboratory of Canada (ULC)

.1 CAN/ULC-S102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

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

.1 Material Safety Data Sheets (MSDS).

.6 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2020(NPC).

.7 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-2019, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.14 - Health and Safety for Contaminated Sites.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to Construction Work Area in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

2 Products

2.1 DWV PIPING AND FITTINGS

.1 For buried DWV piping to:

.2 CSA-B181.1.

.3 CSA-B181.2.

.4 CSA-B182.1.

.2 For aboveground DWV piping for combustible construction to:

.1 CSA – B181.2

.3 For aboveground DWV piping for non-combustible construction:

.1 Flame spread rating less than 25 and smoke developed classification less than 50.

.2 CSA 181.2

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.1 NPS 1 ½ to 6: one step or two step cement

.2 NPS 8 and above: two step cement.

.2 Pipe Supports

.1 As per manufacturer's installation instruction and National Plumbing Code of Canada - 2015

.2 Refer to Structural Drawings and Details for below grade piping supports.

3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 In accordance with Section 22 13 16.16 – Sanitary Waste and Vent Piping - Plastic.

.2 Install in accordance with local authority having jurisdiction and National Plumbing Code.

.3 Insulate all vent piping 3m prior to exterior wall or roof penetration.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure fixtures are properly anchored, connected to system and effectively vented.

.4 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:

.1 The supply and installation of washroom fixtures and trim.

.2 Products installed but not supplied under this section as indicated elsewhere in the contract:

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold-water supplies, waste, and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped for future connection by others.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29.06 - Health and Safety Requirements.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI 112-19.2/CSA B45.1-2018, Ceramic Plumbing Fixtures.

.2 American National Standards Institute/national Sanitation Foundation (ANSI/NSF)

.1 ANSI/NSF 61-2016, Drinking Water System Components.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-B45-02(R2013) Series, Plumbing Fixtures.

.2 CAN/CSA-B125-01, Plumbing Fittings.

.3 CAN/CSA-B651-23, Barrier-Free Design.

.4 Province of Alberta Building code accessibility guide.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit WHMIS SDS -Safety Data Sheets.

.3 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.4 Indicate fixtures and trim:

.1 Dimensions construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 For water closets, urinals: minimum pressure required for flushing.

.5 Closeout Submittals:

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

.2 Include:

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

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

1.7 WARRANTY

.1 Provide a written guarantee, signed, and issued in the name of the owner, against defective materials and workmanship for a period of one (1) year from the date of Substantial Completion.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: Architectural drawings to govern.

.5 Fixtures to be product of one manufacturer and of same type.

.6 Trim to be product of one manufacturer and of same type.

2.2 WATER CLOSETS

	Mounting		Bowl		Flush valve		Flush tank	Barrier-free/Accessible
WC type	Wall	Floor	Elong	Reg	Exp'd	Conc'd		
WC-1		X	X				X	X

.1 Water Closet Seats and Backrests:

.1 Tank type toilet, floor mounted with floor outlet, ultra-high efficiency 4.2LPF, Vitreous china, white finish, polished chrome left-hand trip lever, pressure-assisted flush, speed connect tank/bowl coupling system, close-coupled flushometer tank. ASME A112.19.2 compliant, CSA B45.1 compliant, EPA water sense compliant.

.2 Seat: 820STS-001, for elongated bowl, open front, heavy duty, toilet seat with seat cover, commercial grade hinges, specified in white finish, includes stainless steel hardware.

2.3 WASHROOM LAVATORIES

.1 S-1: American standard MURRO, 0955001EC.020, 0059020EC.020.

.1 Wall-hang lavatory, Vitreous china, EverClean antimicrobial surface, white finish, single hole centerset, rear overflow, faucet ledge with recesses self-draining deck. For concealed arm or wall support, vitreous china shroud/knee contact guard with EverClean (00589020EC),

.2 Sloan faucet, EAF-200-HLT-CP-0.5GPM-AER-IR-FCT, counter mounted, automatic no-touch, hard wired. Polishes chrome finish, single hole center set, brass spout, flexible high-pressure hose, 1.9LPM, (0.5GPM) maximum flow rate, aerated spray outlet, fixed spout, double infrared sensors with automatic setting feature and microprocessor, above deck control access. SL-EAF-11 faucet and flush valve power kit. MX-135-A blow deck mechanical water mixing valve.

2.4 EYEWASH STATION

.1 EE-1: Guardian G1825, pedestal mounted, constructed from stainless steel, GS-Plus, two spray heads with a flip-top dust cover, internal flow control and filter on each spray head, 283mm wide, 1003mm high, chrome plated brass stay-open ball valve, 13mm female inlet supply, schedule 40 galvanized steel, orange polyethylene pipe covers, 32mm females outlet, powder coated cast aluminum handle. ANSI compliant.

Lawler 911E/F Unit 84907 Emergency mixing valve, thermostatic high-flow master water mixing valve.

2.5 MOP SINK

.1 MS-1: FIAT MSB2424100-830AA-834AA-MSGBRKT-MSG24-832AA-889CC-1453BB-QDC3SN000-833AA-E77AA. Molded stone white finish, factory installed stainless steel drain body for caulked joint, chrome-plated service faucet with vacuum breaker, integral stops, adjustable wall brace, pail hook and 19mm hose thread on spout. Service faucet adapter set for two, stainless steel panel, hose and hose bracket, mop hanger, neoprene connecting gasket, silicon sealant, vinyl bumper guard, 610mmx610mmx254mm (LXWXH)

2.6 FIXTURE PIPING

.1 Hot water and cold water supplies to fixtures:

.1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with cleanout on fixtures not having integral trap.

.2 Chrome plated in exposed places.

2.7 CHAIR CARRIERS.

.1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.

3 EXECUTION

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as indicated, measured from finished floor.

.3 For barrier-free washrooms: to comply with most stringent of either NBCC or CAN/CSA B651, or Provincial Building Accessibility Act and Regulations.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.1 Adjustments.

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Adjust flush valves to suit actual site conditions.

.4 Adjust urinal flush timing mechanisms.

.5 Automatic flush valves for urinals and water closets: set controls to prevent unnecessary flush cycles during silent hours.

.2 Checks.

.1 Water closets: flushing action.

.2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Thermostatic controls.

.1 Verify temperature settings, operation of control, limit, and safety controls.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 National Air Duct Cleaners Association (NADCA)

.1 ACR Standard, 2021 edition: Assessment, Cleaning and Restoration of HVAC Systems.

.2 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA 2005 Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.

.3 United States Environmental Protection Agency (US EPA)

.1 US EPA 1999, 40 CFR Parts 152 and 156.

1.2 DEFINITIONS

.1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:

.1 Rigid supply and return ductwork.

.2 Flexible ductwork.

.3 Mixing plenum boxes.

.4 Return air plenums including ceiling plenums.

.5 Cooling and heating coils and compartments.

.6 Condensate drain pans, eliminator blades and humidifiers.

.7 Fans, fan blades and fan housing.

.8 Filter housing and frames.

.9 Acoustically insulated duct linings.

.10 Diffusers, registers, and terminal units.

.11 Dampers and controls.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Site Evaluation: conduct site visits 2 weeks before start of work to establish specific coordinated video survey and cleaning plan to establish specific coordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.

.1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.

.2 Ensure plan identifies sequence and cleaning operations for each individual HVAC system and for complete facility.

.1 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs, and other internal features. The engineer to review video survey and cleaning plan 1 week minimum prior to start of work.

.2 Proceed with survey and cleaning work only after receiving written approval from representative of consultant.

.2 Project Co-ordination: assign Project Co-Ordinator to oversee air duct cleaning processes.

.1 Provide the engineer with contact information of Project Co-Ordinator including: name, telephone number, cell phone number

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit video survey and cleaning plan developed during site evaluation.

.1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.

.3 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.

.4 US EPA Registration: submit verification of EPA Registration of antimicrobial agent.

.5 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

1.5 CLOSEOUT SUBMITTALS

.1 Provide submittals in accordance with Section 01 78 00 - Closeout Submittals.

.2 Post Cleaning Inspection Report: submit Final Inspection Report in PDF format, including data collected, observations and recommendations as well as following information:

.1 Name and address of facility.

.2 Name and address of HVAC cleaning contractor.

.3 Description of HVAC systems with drawings identifying systems cleaned.

.4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used.

.5 Identification of points where samples were collected, and type of analysis used for each collection.

.6 Identification of each sample collected.

.7 Comments complete with photographs of each sampling location and other observed system features. and

.8 Identify systems tested, observations, actions taken and recommendations for future maintenance.

.3 Record post cleaning video survey: submit 2 copies of video survey USB Drive memory media, and include on video survey following:

.1 Areas tested for particulate analysis or microbial growth evaluation.

.2 Areas of special interest and location.

.3 Special internal features.

.4 Problems such as broken or damaged controls or components.

.5 Ensure system tested, locations, observations, actions taken, and recommendations are clearly identified on video using text or voice over.

1.6 EXTRA MATERIALS

.1 Extra Stock Materials:

.1 Supply 4 extra filters for each HVAC System cleaned.

.2 Ensure filters are correct match, size, type, and configuration of existing HVAC Systems.

1.7 QUALITY ASSURANCE

.1 Contractor: verification of membership in NADCA.

.2 Project Co-Ordinator: Air System Cleaning Specialist (ASCS) certified by NADCA on full time basis.

2 Products

2.1 ACCESS DOORS AND PANELS

.1 Equipment Access Doors and Panels: construct from same materials as equipment paneling complete with sealing gasket and positive locking device.

.1 Size access doors and panels in equipment to allow for inspection and cleaning.

.2 Ductwork Access Doors: construct access doors from 1.27 mm minimum galvanized sheet steel with gasketed seal.

.1 Ensure the access door is 25 mm greater in every dimension than the access opening.

.2 Access door size 200 mm x 200 mm minimum.

.3 Secure access doors with sheet metal screws on 75 mm centers minimum. Ensure 3 screws per side minimum.

.3 Access Doors and Panels Acoustic Lining:

.1 Install acoustic lining to match existing.

.2 Self-adhesive glass fiber tape capable of adhering to both acoustic lining and metal access door or panel materials.

.3 Water-based duct sealer for repairing cut acoustic lining.

2.2 ANTIMICROBIAL AGENT

.1 Use antimicrobial agents registered with US EPA-40 CFR.

2.3 SYSTEM FILTERS

.1 Supply and install new filters for each HVAC System cleaned.

2.4 AIR DUCT CLEANING EQUIPMENT

.1 Manually propelled full contact brushes:

.1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment, and components of HVAC system.

.1 Ensure brushes are sized to fit various duct sizes in HVAC system.

.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.

2.5 HEPA FILTER EVACUATION FAN

.1 Evacuation Fan: includes fan, HEPA filter, flexible hose, and motor capable of maintaining debris and particulates airborne in airstream until they reach evacuation fan and maintaining system under negative pressure.

.1 Ensure HEPA filters are clean and maintain evacuation fan and HEPA filter to run efficiently.

2.6 HEPA VACUUM UNIT

.1 Vacuum Unit: includes vacuum fan, integral HEPA filter, suction hose, and vacuum head, capable of maintaining HVAC System debris and particulates airborne in air stream until they reach vacuum unit and maintaining system under negative pressure.

.1 Ensure HEPA filters are clean and maintain vacuum unit and HEPA filter to run efficiently.

3 Execution

3.1 PREPARATION

.1 Close down HVAC system.

.2 Locate and identify externally visible HVAC system features which may affect cleaning process including:

.1 Control devices.

.2 Fire and smoke control dampers.

.3 Balancing dampers: indicate and record positions for resetting.

.4 Air volume control boxes: indicate and record positions for resetting.

.5 Fire alarm devices. and

.6 Monitoring devices and controls.

.3 Cut openings in equipment panels and ductwork for access to system interior.

.1 Square or rectangular opening sizes: 200 mm minimum each side.

.1 Circular opening sizes: 200 mm minimum diameter.

.4 Installation of Access Doors and Panels: install access doors and panels for equipment where instructed by the engineer to facilitate system inspection and cleaning.

.1 Install access doors and panels for inspection and cleaning of equipment as follows:

.1 Heating and cooling coils.

.2 Fan units.

.3 Filters.

.4 Dampers.

.5 Sensors.

.5 Installation of Access Doors in Ductwork: install access doors in ductwork where instructed by the engineer to facilitate system inspection and cleaning.

.1 Access door installation is not permitted in flexible ductwork.

.1 Inspect flexible ductwork only by disconnecting from main duct and inspecting from open end.

.6 When acoustically lined duct is cut for access, repair cut edges of acoustic lining using self-adhesive fiber glass tape and water-based duct sealer.

.1 Adhere new acoustic lining to match existing to inside of access panel or door to ensure continuity of acoustic properties of system.

.7 Remove and reinstall ceiling tiles or panels to gain access to HVAC system as required.

.1 Replace ceiling tiles or panels damaged or soiled by air duct cleaning procedures.

3.2 EXAMINATION / PRE-CLEANING INSPECTION

.1 Verification of Conditions:

.1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.

.2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.

.2 Evaluation and Assessment:

.1 Identify location and type of internal components.

.2 Identify extent of potential problems.

.3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Departmental Representative

.1 Do not proceed further with inspection operations until written approval from Departmental Representative.

3.3 DUCT CLEANING

.1 Do duct cleaning in accordance with NADCA ACR Standard.

.2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass-through other zones which has already been cleaned.

.1 Isolate zone of duct using closed-cell polyurethane foam before cleaning.

.3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.

.4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at another end.

.5 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square meters.

.6 Clean exhaust, return, transfer ductwork and plenums, equipment, and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square meters.

.7 Energize brushes to travel from insertion point to HEPA filter evacuation fan.

.1 Pass brushes through sections as often as necessary to achieve required cleanliness.

.2 Change brush sizes as required to ensure positive contact with duct and component interiors.

.3 Clean corners and pockets where dirt and debris can accumulate.

.8 Clean equipment, components, and other features in isolated zone before moving to next zone of HVAC air duct system.

.9 Clean diffusers, registers, louvers, and other terminal units.

.10 Remove perforated supply diffusers from suspended tee-bar ceiling.

.1 Dismantle and clean perforated plates and supply diffuser duct collars.

.2 Re-assemble perforated plate diffusers and reconnect to HVAC system using supply diffuser duct collar after cleaning.

3.4 ACOUSTICALLY LINED DUCTWORK CLEANING

.1 Clean glass fiber acoustically insulated ducts to NAIMA recommended practices.

.1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fiber lining.

.2 Monitor cleaning process progress by onboard camera.

3.5 COMPONENTS AND EQUIPMENT CLEANING

.1 Brush and vacuum coils, humidifiers, air handling unit enclosures and heat exchanger surfaces to achieve required cleanliness.

.2 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by the engineer for cleaning.

.1 Pressure wash with water and cleaning solution until required cleanliness is achieved.

.2 Clean equipment and components in place only if there are no hazard to adjacent materials.

.3 Proceed to next section in cleaning sequence only after written approval from Departmental Representative.

.4 Compressed air and manual cleaning are acceptable only for cleaning individual components and small areas as follows and only after written approval from Departmental Representative:

.1 Fan blades.

.2 Dampers.

.3 Turning vanes.

.4 Controls.

.5 Sensor bulbs.

.6 Fire alarms.

.7 Smoke detectors.

3.6 FIELD QUALITY CONTROL/FINAL INSPECTIONS

.1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.

.1 Carry out video survey as directed by the engineer.

.2 Include in final survey areas inspected by the engineer prior to cleaning.

.3 Identify on HVAC system record drawings access points used for inspection and cleaning.

.4 Re-collect and analyze particulates collected at same locations where original samples were collected before cleaning.

.5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.7 SYSTEM STARTUP

.1 Install new system filters after cleaning operations are completed.

.2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.

.3 Restart each HVAC system.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings

.2 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for HVAC products for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, the engineer before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

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

.4 Operation instruction for systems and components.

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

.6 Valves schedule and flow diagram.

.7 Color coding chart.

.3 Maintenance data to include:

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

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

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

.2 Equipment performance verification test results.

.3 Special performance data as specified.

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

.5 Approvals:

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

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

.6 Additional data:

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

.7 Site records:

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

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

.3 Use different color waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-built drawings:

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

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

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

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

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

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

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

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

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

.4 Furnish one commercial quality grease gun, grease, and adapters to suit different types of grease and grease fittings.

1.4 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect HVAC products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer.

.2 Inform the engineer 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 the engineer.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 90 00 - Painting.

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

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

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct the following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 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.

3.5 DEMONSTRATION

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

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

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

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

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

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

3.7 PROTECTION

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCE STANDARDS

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

.1 ASHRAE 90.1-10, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

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

.1 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.3 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 The engineer will make available 1 copy of the systems supplier's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives, and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling, and unloading:

.1 Deliver, store and handle in accordance with manufacture’s written instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

2 Products

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 373 W (1/2 HP) speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, voltage refer to mechanical equipment schedule, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by the engineer for temporary use. Work will only be accepted when a specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates allow for center line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives.

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm diameter holes on both shaft centers for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct the following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in Part 1 - Submittals.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in Part 1 - Submittals.

.2 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, as directed in Part 1 – Quality Assurance.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Green Seal Environmental Standards (GSES)

.1 Standard GS-11-2021, 4th Edition, Environmental Standard for Paints and Coatings.

.2 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2015 (NFC).

.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.2 SCAQMD Rule 1168-A2022, Adhesive and Sealant Applications.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.

.1 Primers, Paints and Coating: in accordance with manufacturer's recommendations for surface conditions.

.2 Primer: maximum VOC limit 100 g/L to Standard GS-11.

.3 Paints: maximum VOC limit 100 g/L to Standard GS-11.

.2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Sealants: maximum VOC limit to SCAQMD Rule 1168.

.3 Sealants: maximum VOC limit to SCAQMD Rule 1168.

.4 Adhesives: maximum VOC limit to SCAQMD Rule 1168.

.5 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

3 Execution

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

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

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

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

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

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valves at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

.1 Install manual air vents to CAN/CSA B139 at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Install pipework to CAN/CSA B139.

.2 Screwed fittings jointed with Teflon tape.

.3 Protect openings against entry of foreign material.

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

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

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

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

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

.10 Install, except where indicated, to permit separate thermal insulation of each pipe.

.11 Group piping wherever possible and as indicated.

.12 Ream pipes, remove scales and other foreign material before assembly.

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

.14 Provide for thermal expansion as indicated.

.15 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves at branch take-offs for isolating purposes except where specified.

.7 Install butterfly valves between welded neck flanges to ensure full compression of liner.

.16 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.

.2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.8 SLEEVES

.1 General: install pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for fire stopping.

.2 Maintain the fire-resistance rating integrity of the fire separation.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.9 PREPARATION FOR FIRE STOPPING

.1 Coordinate the installation of fire stopping around pipes, insulation, and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.

.2 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.

.3 Insulated pipes: ensure integrity of insulation and vapor barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush system in accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning supplemented as specified in relevant mechanical sections.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise the engineer 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

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

.5 Conduct tests in the presence of the engineer.

.6 Pay costs for repairs or replacement, retesting, and making good. the engineer to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by the engineer.

3.12 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A53/A53M-22, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-21, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.1 Manufacturer, model number, line contents, pressure, and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.

.1 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication, and recommended procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to Construction Work Area in original factory packaging, labelled with manufacturer's name, address.

2 Products

2.1 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral, or angular movements, as indicated.

.2 Maximum operating pressure: as indicated.

.3 Maximum operating temperature: as indicated.

.4 Type A: controlled flexing, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.5 Type B: externally pressurized, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.6 Bellows:

.1 Multiple bellows, hydraulically formed, two ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.7 Reinforcing or control rings:

.1 2-piece nickel iron.

.8 Ends:

.1 For butt welding, flanges to match pipe.

.9 Liner:

.1 Austenitic stainless steel in direction of flow.

.10 Shroud:

.1 Carbon steel, painted.

2.2 FLEXIBLE CONNECTION

.1 Application: to suit motion as indicated.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset as indicated.

.3 Inner hose: stainless steel corrugated.

.4 Braided wire mesh stainless steel outer jacket.

.5 Diameter and type of end connection: as indicated.

.6 Operating conditions:

.1 Working pressure: 1034 kPa.

.2 Working temperature: 250°C.

.3 To match system requirements.

.7 Three flexible grooved couplings placed in close proximity to vibration source for vibration attenuation and stress relief.

2.3 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

.3 Reinforcement: to Section 03 20 00 - Concrete Reinforcing.

.2 Alignment guides:

.1 Provide as indicated or by conduit manufacturer.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install expansion joints with cold setting, as instructed by design consultant representative. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150% of axial thrust.

.4 Do welding in accordance with section 23 05 17 - Pipe Welding.

3.3 PIPE CLEANING AND START-UP

.1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

3.4 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 13 - Performance Verification HVAC Systems.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 ANSI/ASME B31.1-2022, Power Piping.

.2 ANSI/ASME Boiler and Pressure Vessel Code-2021:

.1 BPVC 2021 Section I: Power Boilers.

.2 BPVC 2021 Section V: Nondestructive Examination.

.3 BPVC 201 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1M/C1.1-2019 Recommended Practices for Resistance Welding.

.2 AWS Z49.1-2012, Safety in Welding, Cutting and Allied Process.

.3 AWS W1-2000 Welding Inspection Handbook.

.4 CSA Group (CSA)

.1 CSA W47.2-11(R2020), Certification of Companies for Fusion Welding of Aluminum.

.2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

.3 CSA B51-14(R2019), Boiler, Pressure Vessel, and Pressure Piping Code.

.4 CSA-W117.2-2012(R2017), Safety in Welding, Cutting and Allied Processes.

.5 CSA W178.1-2018, Certification of Welding Inspection Organizations.

.6 CSA W178.2-2018, Certification of Welding Inspectors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit welder's qualifications to the engineer.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified for CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with manufacturer’s recommendations.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

3 Execution

3.1 APPLICATION

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

3.2 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with the engineer before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with the engineer.

.3 Do not conceal welds until they have been inspected, tested, and approved by the inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

.1 General:

.1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by the engineer.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.2 Hydrostatically test welds to ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by the engineer of total of up to 10 % of welds, selected at random by the engineer by radiographic test.

3.6 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 ASME Fluid Meters: Their Theory and Application, Sixth Edition, 1971

.2 National Electrical Manufacturers Association (NEMA):

.1 NEMA 250-2020, Enclosures for Electrical Equipment (1 000 Volts Maximum)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit manufacturer's product literature, specifications, and datasheets. Include product characteristics, performance criteria, and limitations.

.1 Submit WHMIS Safety Data Sheet (SDS).

.3 Shop Drawings: Submit drawings. Include:

.1 Piping configuration and sizing - straight pipe upstream and downstream, distances to first weld, protrusion, thermowell, and pressure tap.

.2 Service conditions.

.3 Full details of primary elements - standard of design and construction, materials, type serial number, flow rate, differential pressure, irrecoverable head loss (IHL), and calculation sheets.

.4 Accuracy statements for each component at specified flow rates and other conditions.

.5 Flow and temperature ranges.

.6 Signal processor calibration data.

.7 Minimum turndown ratio.

.4 Samples: Include full-size samples of recorder charts and integrator readings.

.5 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.1 Submit maintenance data, including monitoring requirements, and incorporate into operating and maintenance manuals.

1.4 QUALITY ASSURANCE

.1 Health and Safety: Comply with Section [01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Packaging Waste Management and Disposal: Comply with Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

2 Products

2.1 PERFORMANCE CRITERIA

.1 Accuracy: Calculate overall accuracy of each installation using the following expression: Overall accuracy = (E (accuracy of individual components of system) 2)1/2.

.2 Perform accuracy calculations for the following components:

.1 Primary flow measuring elements.

.2 Transmitters: Flow, differential pressure, pressure, temperature, and temperature difference.

.3 Resistance Temperature Detectors (RTD).

.4 Signal processors, recorders.

.5 Calibration of signal processors: Assume 0.20% per processor.

.6 Installation tolerances: Assume 1% for concentricity of pipe, difference in height of transmitter piping.

.3 Show in proposal overall accuracy at 100%, 70%, 10%, and minimum specified design flow rate.

.4 Indicate minimum measurable flow rate.

2.2 HOT WATER METERING

.1 Type of metering:

.1 Wide range thermal power (i.e., demand), thermal energy consumption, supply return temperature, compensated for specific gravity.

.2 Pressure: 550 kPa.

.3 Supply temperature: 60°C.

.2 State in proposal:

.1 Point of change-over.

.2 How change-over will be achieved.

.3 Design differential pressure at normal design flow rate: 25 kPa.

.4 Maximum accuracy of complete meter installation at normal design flow and design temperatures to be +/-10%.

.5 Primary flow measuring elements:

.1 Concentric stainless-steel square-edged thin plate orifice plate mounted between 2000 kPa raised face slip-on orifice flanges having differential NPS 3/4 pressure taps.

.2 Stainless steel, venturi.

.3 Averaging velocity pressure type pitot tube (Annubar).

.6 Standard of design for venturi, primary flow measuring elements: ASME Fluid Meters handbook.

.7 State in proposal maximum irrecoverable head loss (IHL).

.8 Provide manufacturer’s recommended minimum lengths of straight pipe required upstream and downstream of primary element to meet specified accuracy requirements.

.9 Standard of design for venturi, primary flow measuring elements: ASME Fluid Meters handbook.

.10 State in proposal maximum irrecoverable head loss (IHL).

.11 Provide manufacturer’s recommended minimum lengths of straight pipe required upstream and downstream of primary element to meet specified accuracy requirements.

.12 Temperature sensors:

.1 100-ohm RTD.

.2 Thermowells to NPS 3/4 stainless steel thermowell filled with conductive paste with the following insertion lengths:

.1 Up to NPS 6: 75 mm.

.2 NPS 8 and over: 150 mm.

.3 Sensors for temperature difference measurements to be matched pairs.

.13 Acceptable types of transmitters, computing devices, signal conditioners.

.14 Acceptable types of readout instruments:

.1 Integrators: Six-digits, 8-mm high lettering, non-reset.

.2 Paper Recorders: 30 day roll

.3 Paperless Recorders: NEMA 3 rated enclosure.

.1 Display: Minimum 300-mm LCD display, minimum 1024 x 768 resolution.

.2 Communications: 10/100 Ethernet communications port, USB port for input devices.

.3 Configuration: Via network software using ASHRAE BACnet protocol, and touch-screen interface.

.4 Readout and output colors:

.1 Pen #1: thermal power.

.2 Pen #2: water flow rate.

.3 Pen #3: temperature difference.

.15 Readout instrument display:

.1 Thermal power: kW.

.2 Water flow rate: L/s.

.3 Temperature difference: C.

.16 Ambient conditions at transmitters: temperature: C; RH%.

.17 Signal transmission between primary measuring element and signal conditioners:

.1 Power: 24 VDC.

.2 Signal: 4-20 mA

.3 Cable: Color coded, twisted, and shielded pair with grounding wire.

.18 Readout instrument display:

.1 Thermal power: kW.

.2 Water flow rate: L/s.

.3 Temperature difference: C.

.19 Ambient conditions at transmitters: temperature: C; RH%.

.20 Signal transmission between primary measuring element and signal conditioners:

.1 Power: 24 VDC.

.2 Signal: 4-20 mA

.3 Cable: Color coded, twisted, and shielded pair with grounding wire.

3 Execution

3.1 PREPARATION

.1 Before final calculations for orifice diameter, and before purchase of venturi plate, measure:

.1 Internal diameter of main at the primary element to +/- 0.01-mm accuracy.

.2 For concentricity of pipe.

3.2 INSTALLATION

.1 Comply with manufacturer’s installation instructions.

.2 Install differential pressure taps horizontal and level with each other to within +/- 1.5 mm.

.3 Support tubing throughout its length, sloped 5% - 10% upward to main for drainage and venting, without air pockets, with blowdown valves at bottom.

.4 Mount transmitters on [pipe stand] installed and located to ensure no damage by passing traffic.

.5 Signal transmission cable:

.1 Ground shielding at one point only.

.2 Protect against RF interference.

.3 Cross electrical cables and conduits at 90 degrees leaving at least 150-mm space between.

3.3 INSTALLATION –HOT WATER METERS

.1 Locations:

.1 Transmitters: main mechanical room.

.2 Signal conditioners: main mechanical room.

.3 Computing devices: main mechanical room.

.4 Readout instruments: main mechanical room.

.2 Connection to Building Automation System (BAS):

3.4 START-UP

.1 Follow manufacturer’s recommendations.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 53 – Identification for HVAC Piping and Equipment

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B40.100-2022, Pressure Gauges and Gauge Attachments

.2 ASME B40.200-2008(R2013), Thermometers, Direct Reading and Remote Reading

.2 Efficiency Valuation Organization (EVO):

.1 International Performance Measurement and Verification Protocol (IPMVP) – 2022, Core Concepts

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finishes, and limitations.

.3 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 – Common Product Requirements.

.2 Packaging Waste Management: Perform in accordance with Section 01 74 19 – Waste Management and Disposal.

2 Products

2.1 GENERAL

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

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, liquid filled, 125-mm scale length, in accordance with ASME B40.200.

.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 Dial type: 100-mm diameter, mercury-free activated, in accordance with ASME B40.200. Accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb, and polished stainless-steel case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper Pipe: Copper or bronze.

.2 Steel Pipe: Stainless steel.

2.5 PRESSURE GAUGES

.1 Dial type: To ASME B40.100, Grade 2A, 112-mm size, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Diaphragm assembly for corrosive service.

.3 Gasketed pressure relief back with solid front.

.4 Bronze stop cock.

.5 Oil filled for high vibration applications.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed are acceptable for installation in accordance with manufacturer's instructions.

.1 Inform representative of consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from representative of consultant.

3.2 INSTALLATION

.1 Install thermometers and gauges so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations and on inlet and outlet of:

.1 Heat exchangers.

.2 Water heating and cooling coils.

.3 Water boilers.

.4 DHW tanks.

.3 Install wells for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of pressure reducing valves.

.3 Upstream and downstream of control valves.

.4 Inlet and outlet of coils.

.5 Inlet and outlet of liquid side of heat exchangers.

.6 Outlet of boilers.

.2 Install gauge cocks for balancing purposes elsewhere.

.3 Use extensions through insulation where pressure gauges are installed.

3.5 NAMEPLATES

.1 Install nameplates in accordance with Section 23 05 53 – Identification for HVAC Piping and Equipment, identifying medium.

3.6 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by installation of work in this Section.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 ANSI/ASME B1.20.1-2013(R2018), Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18-2021, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International

.1 ASTM A276-13a, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283/283M-22, Standard Specification for Copper, and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M-22, Standard Specification for Copper Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS-SP-25-2018, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80-2019, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittals.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit data for valves specified in this Section.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00- Closeout Procedures.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.1 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10 valves, each size. Minimum 1.

.3 Stem packing: one for every 10 valves, each size. Minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints.

.2 Tools:

.1 Furnish special tools for maintenance of systems and equipment.

.2 Include following:

.1 Lubricant gun for expansion joints.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

2.1 MATERIALS

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.

.2 Products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.

.2 Copper tube systems: solder ends to ANSI/ASME B16.18.

.3 Lock shield Keys:

.1 Where lock shield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Packing: non-asbestos.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: Handwheel.

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: handwheel.

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.

.3 Operator: handwheel.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: handwheel.

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, union.

.2 Operator: handwheel.

.5 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating PTFE disc, regrind able bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: handwheel.

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrind able bronze seat, loosely secured to bronze stem to ASTM B505.

.3 Operator: handwheel.

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrind able bronze seat, loosely secured to stem.

.3 Operator: lock shield.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrind able.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrind able.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable no. 6 composition PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class125.

.3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-22, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A125-1996(2018), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-2021, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.3 ASTM A563/A563M, 2022, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

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

.1 MSS SP58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2020 (NPC).

.6 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings.

.2 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

.1 The engineer will make available 1 copy of the systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer’s recommendations utilizing manufacturer's regular production components, parts, and assemblies.

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

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

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

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

.2 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers to withstand seismic events

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1.

.2 Use components for intended design purposes only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports galvanized painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maxima: malleable iron C-clamp with hardened steel cup point setscrew, locknut.

.1 Rod: 9 mm UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maxima: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP58.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:

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

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP58.

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

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

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

.3 Do not use 22 mm or 28 mm rod.

.6 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.7 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for riveting to insulation shields.

.8 Yoke style pipe roll: carbon steel yoke, rod, and nuts with cast iron roll, to MSS SP58.

.9 U-bolts: carbon steel to MSS SP58 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black.

.2 Finishes for copper, glass, brass, or aluminum pipework: galvanized, with formed portion plastic coated.

.10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP58.

2.4 RISER CLAMPS

.1 Steel or cast-iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in center plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/- 5% spring rate tolerance, tested for free height, spring rate, loaded height, and provided with Certified Mill Test Report (CMTR).

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

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

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

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

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height, and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.10 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrications.

2.11 HOUSE-KEEPING PADS

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

.2 Concrete: to Section 03 30 00.01 - Cast-in-Place Concrete Short Form.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

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

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to National Plumbing Code of Canada (NPC).

.2 Copper piping: up to NPS 1/2: every 1.5 m.

.3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.4 Within 300 mm of each elbow.

.5 Pipework greater than NPS 12: to MSS SP58.

3.4 HANGER INSTALLATION

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

.2 Adjust hangers to equalize load.

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

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

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

.2 Tighten upper nut after adjustment.

.3 C-clamps:

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

.4 Beam clamps:

.1 Hammer jaw firmly against the underside of beam.

3.7 FIELD QUALITY CONTROL

.1 Site Tests: conduct the following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 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, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 Safety Data Sheets (SDS)

.2 National Fire Protection Association (NFPA)

.1 NFPA 13-2022, Standard for the Installation of Sprinkler Systems.

.3 National Research Council Canada (NRC)

.1 National Building Code of Canada 2020 (NBC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Shop drawings: Submit drawings.

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 The Engineer will make available copy of systems supplier's installation instructions.

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

1.3 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling, and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.3 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometers; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30durometer natural rubber; maximum loading 415kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.4 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.5 SPRINGS

.1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.

.3 Cadmium plate for outdoor100% relative humidity installations.

.4 Colour code springs.

2.6 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

.6 Performance: as indicated.

2.7 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal-to-metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

.6 Performance: as indicated.

2.8 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy-duty duck and neoprene isolation material.

2.9 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.10 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm minimum.

2.11 ROOF CURB ISOLATION RAILS

.1 General: complete factory assembled without need for sub-base.

.2 Lower member: continuous rectangular steel tube or extruded aluminum channel.

.3 Upper member: continuous rectangular steel tube or extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene snubber bushings 6 mm thick to resist wind forces.

.4 Springs: steel, adjustable, removable, selected for 25 mm maximum static deflection plus 50% additional travel to solid, cadmium plated, sized, and positioned to ensure uniform deflection.

.5 High frequency isolation: 6 mm minimum thick continuous gasket on top and bottom of complete assembly or pads on top and bottom of each spring. Material: closed cell neoprene.

.6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: aluminum

.7 Hardware: cadmium plated or galvanized.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Where isolation is bolted to floor use vibration isolation rubber washers.

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

3.3 FIELD QUALITY CONTROL

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 After delivery and storage of Products.

.2 After preparatory work is complete but before installation commences.

.3 Twice during the installation, at 25 % and 60% completion stages.

.4 Upon completion of installation.

.3 Submit manufacturer's reports to the Engineer within 3 days of manufacturer representative's review.

.4 Make adjustments and corrections in accordance with written report.

.5 Inspection and Certification:

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after starting up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.2 Take vibration measurements for equipment as indicated.

.3 Provide the Engineer with notice 24 hours in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

.5 Submit complete report of test results including sound curves.

.6 Verification requirements in accordance with Section 01 33 29 - Sustainable Design Reporting, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Certified wood.

.8 Low-emitting materials.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

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

.2 Sustainable requirements for construction and verification.

1.2 REFERENCE STANDARDS

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1-20, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

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

.2 CAN/CGSB-24.3-12, Standard for Pipe Identification

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Product data to include paint color chips, other products specified in this section.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

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

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

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

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

2.2 SYSTEM NAMEPLATES

.1 Colors:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

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

.3 Sizes:

.1 Conform to following table:

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

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

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background color marking, pictogram (as necessary), legend, direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

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

.3 Legend:

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

.4 Arrows showing direction of flow:

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

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

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

.5 Extent of background color marking:

.1 To full circumference of pipe or insulation.

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

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

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

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

.7 Colors and Legends:

.1 Where not listed, obtain direction from the engineer.

.2 Colors for legends, arrows: to following table:

Background color:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background color marking and legends for piping systems:

Contents	**Background color marking**	**Legend**
City water	Green	CITY WATER
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold-water supply	Green	DOM. CWS
Wastewater	Green	WASTEWATER
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	to Codes	

2.5 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.

.2 Colors: back or coordinated with base color to ensure strong contrast.

2.6 VALVES, CONTROLLERS

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

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 CONTROLS COMPONENTS IDENTIFICATION

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

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

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified Section 09 90 00 - Painting has been completed.

3.3 INSTALLATION

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

.2 Provide ULC and CSA registration plates as required by respective agency.

.3 Identify systems and equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

.1 Locations:

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

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate, or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

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

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

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

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on the upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

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

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

.3 Number valves in each system consecutively.

3.7 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Section, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Certified wood.

.8 Low-emitting materials.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 SUMMARY

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

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

1.2 QUALIFICATIONS OF TAB PERSONNEL

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

.2 Provide documentation confirming qualifications, successful experience.

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

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2016.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2015.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC Systems - Testing, Adjusting and Balancing-2002.

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

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

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

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

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

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

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

1.3 PURPOSE OF TAB

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

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

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

1.4 EXCEPTIONS

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

1.5 CO-ORDINATION

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

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

1.6 PRE-TAB REVIEW

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

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

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

1.7 START-UP

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

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

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

1.9 START OF TAB

.1 Notify the engineer 7 days prior to the start of TAB.

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

.3 Installation of ceilings, doors, windows, and other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

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

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

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

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

.4 Correct fan rotation.

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

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed; volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

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

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

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

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

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to the engineer.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

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

.3 Submit for checking and approval of the engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.14 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to the engineer for verification and approval, in English and in D-ring binders, complete with index tabs.

1.15 VERIFICATION

.1 Reported results subject to verification by the engineer.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by the engineer.

.4 Pay costs to repeat TAB as required to satisfaction of the engineer.

1.16 SETTINGS

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

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

1.17 COMPLETION OF TAB

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

1.18 AIR SYSTEMS

.1 Standard: TAB standards of SMACNA.

.2 Do TAB of systems, equipment, components, controls specified Division 23

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

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

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

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run out (or grille, register or diffuser).

1.19 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to always ensure specified pressure conditions during.

.3 Measure DBT, WBT, air velocity, air flow patterns, NC levels, in occupied areas

.4 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.

1.2 REFERENCE STANDARDS

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

.1 Safety Data Sheets (SDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to the engineer for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from the engineer.

.2 Prepare report of results and submit to the engineer within 24 hours of completion of tests. Include:

.1 Schematic of entire system.

.2 Schematic of section under test showing test site.

.3 Required and achieved static pressures.

.4 Orifice differential pressure at test sites.

.5 Permissible and actual leakage flow rate (L/s) for test sites.

.6 Witnessed certification of results.

.3 Include test reports in final TAB report.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.07 – Occupational Health and Safety Act.

2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.

.3 Submit details of test instruments to be used to the engineer at least three months before the anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with the engineer no more than 28 days before start of tests.

.5 Re-calibrated every six months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and system components such as duct heating leakage: 2%.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:

.1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: leakage 2%.

.2 Large low pressure duct systems up to 500 Pa: leakage 2%.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

.4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

.1 Have manufacturer of products, supplied under this Section, review Work involved in the 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, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports within 3 days of review and submit them immediately to the engineer.

.2 Performance Verification:

.1 The engineer to witness tests and verifies reported results.

.2 To be certified by the same TAB agency approved by the *engineer* to undertake TAB on this project.

3.6 CLEANING

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 ANSI/ASHRAE/IESNA 90.1-10, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM)

.1 ASTM B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449-07(R19), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547-22a, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-13(2019), Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612—14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)

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

.4 Green Seal Environmental Standards (GSES)

.1 Standard GS-36 2013, Adhesive for Commercial Use.

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2022, Adhesive and Sealant Applications.

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

.7 Underwriters Laboratories of Canada (ULC)

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

.2 CAN/ULC-S701.1-17, Standard for Thermal Insulation, Polystyrene, Boards Fifth Edition

1.2 DEFINITIONS

.1 For purposes of this section:

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

.2 "EXPOSED" - means "not concealed" as previously defined.

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

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

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

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list.

.3 Shop Drawings:

.1 Submit drawings.

.4 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.5 Manufacturers' Instructions:

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

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fiber: as specified includes glass fiber, rock wool, slag wool.

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

.3 TIAC Code C-1: Rigid mineral fiber board to ASTM C612, with factory applied vapor retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapor retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fiber: to ASTM C553.

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

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

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.3 Aluminum:

.1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Smooth.

.4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

.1 Stainless steel:

.5 Type: 304.

.6 Thickness: 0.25 mm sheet.

.7 Finish: Smooth.

.8 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapor retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.2 Indoor Vapor Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C921.

.5 Outdoor Vapor Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

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

.6 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.7 Contact adhesive: quick setting

.1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.8 Canvas adhesive: washable.

.1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.

.9 Tie wire: 1.5 mm stainless steel.

.10 Banding: 12 mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation.

.12 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

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

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

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

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapor retarder jacket and finishes.

.1 Ensure hangers and supports are outside vapor retarder jacket.

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

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on center in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Round cold and dual temperature supply air ducts (concealed)	C-2	yes	50
Rectangular warm air ducts (exposed)	C-1	no	25
Round warm air ducts (exposed)	C-1	no	25
Rectangular cold and dual temperature supply air ducts (concealed)	C-2	Yes	25

	TIAC Code	Vapour Retarder	Thickness (mm)
Round cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Rectangular warm air ducts (concealed)	C-2	No	25
Round warm air ducts (concealed)	C-2	No	25
Supply, return, and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	25
Exhaust duct between dampers and louvers	C-1	no	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Infrared heater combustion air w/ jacket	C-1	Yes	50

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.3 Finishes: conform to following table:

	TIAC Code	
	Rectangular	**Round**
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

.2 Related Requirements

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 07 92 00 – Joint Sealing.

.3 Section 23 05 53– Mechanical Identification

1.2 REFERENCE STANDARDS

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

.1 ASHRAE Standard 90.1-10 Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 ASTM International (ASTM)

.1 ASTM B209M-14 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

.2 ASTM C335/C335M-17 Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-19 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-07(2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533-2017, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-22a Standard Specification for Mineral Fiber Pipe Insulation.

.7 ASTM C795-08(2018) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 2012

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

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

.1 Safety Data Sheets (SDS).

.5 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2018 Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701.1-2017 Thermal Insulation, Polystyrene, Boards

.3 CAN/ULC-S702-2015, Mineral Fibre Thermal Insulation for Buildings

.4 CAN/ULC-S702.2-15, Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation

1.3 DEFINITIONS

.1 For purposes of this section:

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

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Shop drawings: Submit drawings.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 The engineer will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing work of this Section and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

.3 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.07 – Occupational Health and Safety Act.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling, and unloading:

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

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

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702

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

.3 Maximum "k" factor: to CAN/ULC-S702

.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.

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

.3 Maximum "k" factor: to CAN/ULC-S702.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.

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

.3 Certified by manufacturer: free of potential stress corrosion cracking corrodents.

.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C533

.2 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19mm wide, 0.5mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

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

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint

.3 Minimum service temperatures: -20 degrees C.

.4 Maximum service temperature: 65 degrees C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.7 Special requirements:

.1 Outdoor: UV rated material at least 0.5 mm thick.

.2 ABS Plastic:

.1 One-piece moulded type with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint

.3 Minimum service temperatures: -40 degrees C.

.4 Maximum service temperature: 82 degrees C.

.5 Moisture vapour transmission: 0.012 perm.

.6 Thickness: 0.75mm.

.7 Fastenings:

.1 Solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Locations:

.1 For outdoor use ONLY.

.3 Aluminum:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: smooth

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealants.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

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

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PREFABRICATED, INSULATION AND ENCLOSURES

.1 Application: at expansion joints, valves, flanges, and unions at equipment.

.2 Design: to permit movement of expansion joint without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings, and finishes: same as system.

.2 Jacket: aluminum.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: SS bands at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.

.1 Securements: SS bands at 300 mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Insulation securements: as per manufacturer's recommendation.

.2 Seals: lap seal adhesive, lagging adhesive.

.5 TIAC Code: C-2 vapour retarder jacket.

.1 Insulation securements: as per manufacturer's recommendation.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.

.1 Insulation securements: as per manufacturer's recommendation.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.

.1 Run outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	**Temp ºC**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**					
	Run out			***to 1***	***1 1/4 to 2***	***2 1/2 to 4***	***5 to 6***	***8 & over***
Boiler Feed Water		A-3	25	25	25	25	25	25
Hot Water Heating	60 - 94	A-3	25	38	38	38	38	38
Hot Water Heating	up to 59	A-3	25	25	25	25	38	38

Application	**Temp ºC**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**					
	Run out			***to 1***	***1 1/4 to 2***	***2 1/2 to 4***	***5 to 6***	***8 & over***
Glycol Heating	60 - 94	A-3	25	38	38	38	38	38
Glycol Heating	up to 59	A-3	25	25	25	25	38	38
Domestic HWS		A-3	25	25	25	38	38	38

Application	**Temp ºC**	**TIAC code**	**Pipe sizes (NPS) and insulation thickness (mm)**					
	Run out			***to 1***	***1 1/4 to 2***	***2 1/2 to 4***	***5 to 6***	***8 & over***
Domestic CWS		A-3	25	25	25	25	25	25
Refrigerant hot gas, liquid, suction	4-13	A-6	25	25	25	25	25	25
Refrigerant hot gas, liquid, suction	below4	A-6	25	25	25	25	25	25
RWL and RWP		A-3	25	25	25	25	25	25
Cooling Coil cond. Drain		A-3	25	25	25	25	25	25
Diesel generator exhaust system		A-2	38	65	65	75	90	90
Roof Drain Body		C-2	25	25	25	25	25	25

.8 Finishes:

.1 Exposed indoors: aluminum jacket.

.2 Exposed in mechanical rooms: aluminum jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: waterproof aluminum jacket.

.6 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E202-18 Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures, and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Boiler and/or chiller operation.

.3 Pressure bypass open/closed.

.4 Control pressure failure.

.5 Maximum heating demand.

.6 Maximum cooling demand.

.7 Boiler and/or chiller failure.

.8 Cooling tower (and/or industrial fluid cooler) fan failure.

.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.4 HYDRONIC SYSTEM CAPACITY TEST

.1 Perform hydronic system capacity tests after:

.1 TAB has been completed.

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Heating system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures to ensure that coils are not subjected to freezing conditions) or

.2 Reducing space temperature by turning of heating system for sufficient period before starting testing.

.2 Test procedures:

.1 Open fully heat exchanger, heating coil and radiation control valves.

.2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.

.3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

1.5 GLYCOL SYSTEMS

.1 Test to prove concentration will prevent freezing to minus 45 degrees C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

1.6 REPORTS

.1 Submit system test reports for the engineer of record for review.

1.7 TRAINING

.1 In accordance with Section 01 66 40 – Training. Supplemented as specified herein.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E202-18, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

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

.1 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications, and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Instructions: submit manufacturer's installation instructions.

.1 The engineer will make available 1 copy of the systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.07 – Occupational Health and Safety Act.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling, and unloading:

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

2 Products

2.1 SUSTAINABLE REQUIREMENTS

2.2 CLEANING SOLUTIONS

.1 Low foaming detergent at all temperatures

.2 No pH neutralization required

.3 Designed for use on most metals including aluminum

.4 Bio-degradable

.5 Phosphate Free

.6 Nitrite Free

3 Execution

3.1 CLEANING HYDRONIC SYSTEM

.1 Timing

.1 Systems to be operational, hydrostatically tested and with safety devices functional before cleaning is carried out.

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations to be used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems

.1 Systems to be free from construction debris, dirt, and other foreign material.

.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers to be clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

.1 Flush system thoroughly with water, back flush pump, strainers, blow down drain valves and risers to remove all loose debris. Remove accumulated sludge in boilers if necessary.

.2 Then add 2% solution of low foaming detergent to the system through a by-pass feeder or another feeding device.

.3 Circulate for 36 hours at 82^{o} C. For chilled systems, circulate at least 48 hours at ambient temperature.

.4 During recirculation, back flush strainers, drain valves and risers at their lowest point once every 8 hours.

.5 Drain cleaning water completely.

.6 Then fill and drain system several times. Circulate 30 minutes every time the system is refilled.

.7 Bleed system at several points until water is clear and non-foaming. Clean pump strainers.

.8 Draw a water sample from the system and send it to out laboratory for analysis.

.9 If the laboratory report is satisfactory, the system must then be treated with the appropriate formula.

.8 Glycol Systems:

.1 In addition to procedures specified above perform procedures specified herein.

.2 Test to prove concentration will prevent freezing to minus 40^{o} C. Test inhibitor strength and include in procedural report. Refer to ASTM E202.

3.2 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure slowly over a 48 hour period.

.11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing (TAB).

.12 Adjust pipe supports, hangers, springs, as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.16 Check operation of drain valves.

.17 Adjust valve stem packings as systems settle down.

.18 Fully open all balancing valves (except those that are factory-set).

.19 Check operation of over-temperature protection devices on circulating pumps.

.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.3 MANUFACTURER'S INSTRUCTIONS

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

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 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 Store material indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electric and electronic control systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 THERMOSTAT (LINE VOLTAGE-HEATING AND COOLING)

.1 Line voltage, wall-mounted thermostat, for heating or cooling or heating-cooling as indicated with:

.2 Full load rating: 6 A at 120 V.

.3 Temperature setting range: 5° C to 30° C.

.4 Thermometer range: 5° C to 30° C.

.5 Markings in 5 degree increments.

.6 Differential temperature fixed at 1.1° C.

2.2 THERMOSTAT (HEAVY-DUTY, LINE VOLTAGE, HEATING AND COOLING)

.1 Heavy-duty line voltage thermostat for heating, cooling, heating/cooling with manual changeover two- stage heating or cooling heating/cooling automatic changeover as indicated with:

.2 Full load rating: 16 A at 120 V.

.3 Temperature setting range: 5° C to 30° C.

.4 Thermometer range: 5° C to 30° C.

.5 Markings in 5 o degree increments.

.6 Differential temperature fixed at 1.1° C.

2.3 THERMOSTAT (LINE VOLTAGE, HEATING)

.1 Line voltage wall mounted integral electric heating thermostat with:

.2 Full load rating: 22 A at 120 V.

.3 Temperature setting range: 5° C to 30° C.

.4 Single pole.

.5 Thermometer range: 5° C to 30° C.

.6 Scale markings: Off-5-10-15-20-25° C.

2.4 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:

.2 For use on 24 V circuit at 1.5 A capacity.

.3 With heat anticipator adjustable 0.1 to 1.2 A.

.4 Temperature setting range: 10° C to 25° C.

.5 Without sub-base.

2.5 THERMOSTAT (REMOTE BULB)

.1 Line voltage remote bulb type thermostat with:

.1 30 A rating on 120 V.

.2 3 m copper capillary tube.

.3 Moisture and dust-resistant enclosure.

2.6 THERMOSTAT (FAN COIL)

.1 Line voltage fan coil heating-cooling thermostat with:

.2 Full load rating: 6 A at 120 V.

.3 Two rocker switches for "Heat-Off-Cool" and "Low-Medium-High" fan switching. Isolate heating and cooling circuits. "Off" switch to break power to fan and thermostat.

2.7 THERMOSTAT GUARDS

.1 Thermostat guards: lockable, clear opaque plastic cast metal. Slots for air circulation to thermostat.

2.8 LOW LIMIT TEMPERATURE ALARM

.1 Low limit temperature alarm with:

.2 Rating: 10.2 A at 120 V.

.3 Sensing bulb and 6 m long capillary tube.

.4 Switching action: manual reset.

.5 Temperature setting range: 0° C to 15° C.

2.9 HIGH LIMIT TEMPERATURE ALARM

.1 High limit temperature alarm with:

.2 Rating 10 A at 120 V 6 A at 240 V.

.3 Positive lock-out.

.4 Manual reset only after 14 EC drop-in temperature.

.5 Cutout setting: 50° C.

2.10 SAIL SWITCH

.1 Sail switch, mercury bulb type with stainless steel sail 79 mm width, adjustable range set for 3.8 m/s air velocity with upward flow. Full load: 16 A at 120 V. Maximum ambient temperature: 82° C.

.2 Flow switch for water or glycol, pipe size as indicated, CSA Enclosure l, rated at 16 A at 120 V. Maximum liquid temperature: 121° C. Maximum liquid gauge pressure of 1034 kPa ambient temperature range 0° C and 82° C. Ensure flow rate can activate flow switch at its minimum flow setting.

2.11 PRESSURE SWITCH

.1 Pressure switch for water, steam, air at range to suit application with auto manual reset, contacts open on rise. Maximum allowable gauge pressure of 1.2 MPa. Full load 16 A at 120 V, ULC rated.

2.12 TEMPERATURE SENSORS

.1 Temperature sensors supplied, installed and wired by Division 25. Component of EMCS System. Electrical Division to provide box and conduit to ceiling space only.

2.13 ELECTRIC HEATING RELAYS

.1 Low voltage solid state electric heating relays installed in ventilated enclosure, recess mounted, complete with power supply. Complete assembly to be CSA approved.

.2 Heating relays, c/w integral heat sink, over voltage protection and status LED.

.3 Relay to have veiled conductor connections. No exposed terminals permitted.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer.

.2 Inform the engineer 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 the engineer.

3.2 INSTALLATION

.1 Install control devices.

.2 On the outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)

.1 ANSI/AWS A5.8/A5.8M-11, AMD1 Specification Filler Metals for Brazing and Braze Welding.

.2 ASME

.1 ANSI/ASME B16.15-18, Cast Copper Alloy Threaded Fittings Classes 125 and 250.

.2 ANSI B16.18-21, Cast Copper Alloy, Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-21, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 ASTM International (ASTM)

.1 ASTM B32-20, Standard Specification for Solder Metal.

.2 ASTM B61-15(2021), Standard Specification for Steam or Valve Bronze Castings.

.3 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.

.4 ASTM B88M-05(2020), Standard Specification for Seamless Copper Water Tube - Metric.

.5 ASTM E202-18, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

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

.1 Safety Data Sheets (SDS).

.5 Manufacturers Standardization Society (MSS)

.1 MSS SP80-2019, Bronze Gate, Globe, Angle and Check Valves.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.2 Submit 2 copies of WHMIS SDS in accordance with local code and the requirements of the Authority Having Jurisdiction.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Northwest Territories, Canada.

.2 Indicate on manufacturers catalogue literature the following: valves.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.

.3 Submit two copies of operation and maintenance manual in accordance with 01 33 00 Submittals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Furnish following spare parts:

.1 Valve seats: one for every ten valves, each size. Minimum one.

.2 Discs: one for every ten valves, each size. Minimum one.

.3 Stem packing: one for every ten valves, each size. Minimum one.

.4 Valve handles: two of each size.

.5 Gaskets for flanges: one for every ten flanges.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with regulations of Alberta.

1.6 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 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hydronic systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 50 – Construction Waste Management and Disposal.

2 Products

2.1 PIPING

.1 Heating systems, within building.

.1 Above ground.

.2 Copper tube, hard drawn, type K: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.

.3 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

.4 Use dielectric union/part to connect two different metal pipes.

2.3 FLANGES

.1 Brass or bronze: threaded.

2.4 JOINTS

.1 Silver solder BCUP: to ANSI/AWS A5.8.

.2 Brazing: as indicated.

2.5 VALVES

.1 Connections:

.1 NPS 2 and smaller: ends for soldering.

.2 Gate Valves: application: isolating equipment, control valves:

.1 NPS 2 and under:

.1 Class 125, rising stem split wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.3 Globe valves: application: throttling, flow control, emergency bypass:

.1 NPS 2 and under:

.1 With PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.

.4 Balancing, for TAB:

.1 Sizes: calibrated balancing valves, as specified.

.2 NPS 2 and under:

.1 Globe, with plug disc as specified Section 23 05 23.01 - Valves - Bronze.

.5 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.

.6 Bypass valves on NPS 3/4, globe, with PTFE disc as specified Section 23 05 23.01 - Valves - Bronze.

.7 Swing check valves:

.1 NPS 2 and under:

.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.8 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01 - Valves - Bronze.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of consultant Representative.

.2 Inform Departmental Representative 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 Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.4 Slope piping in direction of drainage and for positive venting.

.5 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.7 Assemble piping using fittings manufactured to ANSI standards.

3.4 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install gate or ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.3 Install globe valves for balancing and in by-pass around control valves as indicated.

.4 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.5 Install ball valves for glycol service.

3.5 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and TAB is complete.

3.6 FLUSHING AND CLEANING

.1 Flush and clean in presence of consultant Representative.

.2 Flush after pressure test for a minimum of 4 hours.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hours.

.4 Refill system with clean water. Circulate for at least 4 hours. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining consultant Representative’s approval.

3.7 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment and glycol as specified.

3.8 FIELD QUALITY CONTROL

.1 Testing:

.1 Test system in accordance with Section 23 05 00 - Common Work Results for HVAC.

.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

.2 Balancing:

.1 Balance water systems to within plus or minus 5% of design output.

.2 Refer to Section 23 05 00 - Common Work Results for HVAC for applicable procedures.

.3 Glycol Charging:

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

.3 Provide report to Departmental Representative.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 50 – Construction Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2021.

.2 ASTM International (ASTM)

.1 ASTM A47/A47M-99(2022), Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A278/A278M-01(2020), Standard Specification for Grey Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).

.3 ASTM A516/A516M-10(2017), Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.

.4 ASTM A536-84(2019), Standard Specification for Ductile Iron Castings.

.5 ASTM B62-17, Standard Specification for Composition Bronze, or Ounce Metal Castings.

.3 CSA Group (CSA)

.1 CSA B51-19, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Submit drawings in accordance with Section 01 33 00 – Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic specialties for incorporation into manual.

.3 Submit 2 copies of operation and maintenance manual.

1.4 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 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hydronic specialties from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 DIAPHRAGM TYPE EXPANSION TANK

.1 Vertical galvanized steel pressurized diaphragm type expansion tank.

.2 Capacity: as indicated on mechanical schedules.

.3 Size: as indicated on mechanical schedules.

.4 Diaphragm sealed in EPDM suitable for 115 degrees C operating temperature.

.5 Working pressure: 860 kPa with ASME stamp and certification.

.6 Air pre-charged to 84 kPa (initial fill pressure of system).

.7 Base mount for vertical installation.

.8 Supports: provide supports with hold down bolts and installation templates.

.9 Renewable diaphragm.

2.2 AUTOMATIC AIR VENT

.1 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.

.2 Float: solid material suitable for 115 degrees C working temperature.

2.3 AIR SEPARATOR IN-LINE

.1 Working pressure: 860 kPa.

.2 Size: as indicated on mechanical schedules.

2.4 COMBINATION SEPARATORS/STRAINERS

.1 Steel, tested and stamped in accordance with ASME BPVC, for 860 kPa operating pressure, with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.5 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: 206 kPa relief, 55 to 172 kPa reducing.

.2 Low inlet pressure check valve.

.3 Removable strainer.

2.6 PIPELINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, screwed connections, Y pattern.

.2 NPS 2 1/2 to 12: cast steel body to ASTM A278/A278M, Class 30, flanged connections.

.3 Blowdown connection: NPS 1.

.4 Screen: stainless steel with 1.19 mm perforations.

.5 Working pressure: 860 kPa.

2.7 DIELECTRIC UNIONS

.1 Use dielectric unions for any transitions in piping materials.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic specialties installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of representative of consultant.

.2 Inform representative of 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 representative of consultant.

3.2 APPLICATION

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

3.3 GENERAL

.1 Run drain lines and blow off connections to terminate above nearest drain.

.2 Maintain adequate clearance to permit service and maintenance.

.3 Should deviations beyond allowable clearances arise, request, and follow representative of consultant directive.

.4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.4 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Clearance to be provided for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve larger than NPS 1 and radiation and as indicated.

3.5 AIR VENTS

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

3.6 EXPANSION TANKS

.1 Adjust expansion tank pressure as indicated.

.2 Install lock shield type valve at inlet to tank.

3.7 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.8 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 50.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 50 – Construction Waste Management and Disposal.

.1 Remove recycling containers and bins from Site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 National Energy Code of Canada for Buildings 2020

.2 CSA Group (CSA)

.1 CAN/CSA-B214-21, Installation Code for Hydronic Heating Systems.

.3 Electrical Equipment Manufacturers Association of Canada (EEMAC)

.4 National Electrical Manufacturers' Association (NEMA)

.5 NEMA MG 1-2021, Motors and Generators.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pump, circulator, and equipment and include product characteristics, performance criteria, physical size, finish, and limitations indicate point of operation, and final location in field assembly.

.3 Shop Drawings:

.1 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, and controllers.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic pumps for incorporation into manual.

.3 Submit 2 copies of operation and maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hydronic pumps from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets,

.5 crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish following spare parts:

.3 Mechanical seal for each pump.

.4 Packing for each pump.

.5 Set of gaskets for each pump.

2 Products

2.1 EQUIPMENT

.1 Size and select components to: CAN/CSA-B214.

2.2 IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: alloy steel, cast bronze, or cast iron to suit application.

.3 Shaft: stainless steel with bronze sleeve bearing integral thrust collar.

.4 Seal assembly: mechanical for service to 135°C.

.5 Coupling: flexible self-aligning.

.6 Motor: as per Section 23 05 13 – Common Motor Requirements for HVAC Equipment and as per manufacturer’s recommendations. Speed and power as indicated in the pump schedule.

.7 Capacity: as indicated in the pump schedule.

.8 Design pressure: 1200 kPa.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic pump installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of representative of consultant.

.2 Inform representative of 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 representative of consultant.

3.2 APPLICATION

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

3.3 INSTALLATION

.1 Install hydronic pumps to: CAN/CSA-B214.

.2 In line circulators: install as indicated by flow arrows.

.1 Support at inlet and outlet flanges or unions.

.2 Install with bearing lubrication points accessible.

.3 Base mounted type: supply templates for anchor bolt placement.

.1 Include anchor bolts with sleeves. Place level, shim unit and grout.

.2 Align coupling in accordance with manufacturer's recommended tolerance.

.3 Check oil level and lubricate. After run-in, tighten glands.

.4 Pump body shall not support piping or equipment.

.1 Provide stanchions or hangers for this purpose.

.2 Refer to manufacturer's installation instructions for details.

.5 Pipe drain tapping to floor drain.

.6 Install volute venting pet cock in accessible location.

.7 Check rotation prior to start-up.

.8 Install pressure gauge test cocks.

3.4 START-UP

.1 General:

.1 In accordance with Section 01 78 25 – Facility Startup/Commissioning: General Requirements; supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours minimum.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.

.10 Adjust alignment of piping and conduit for true flexibility.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

3.5 PERFORMANCE VERIFICATION (PV)

.1 General:

.1 Verify performance in accordance with Section 01 78 25 – Facility Startup/Commissioning: General Requirements, supplemented as specified herein.

.2 Verify that manufacturer's performance curves are accurate.

.3 Valves on pump suction and discharge shall provide tight shut-off.

.4 Net Positive Suction Head (NPSH):

.1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Measure using procedures prescribed in Section 01 78 25 – Facility Startup/Commissioning.

.3 Where procedures do not exist, discontinue PV, report to MCM and await instructions.

.5 Multiple Pump Installations - Series and Parallel:

.1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.

.6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.7 Commissioning Reports: in accordance with Section 01 78 25 – Facility Startup/Commissioning reports supplemented as specified herein. Reports to include:

.1 Record of points of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.

.2 Use Report Forms specified in Section 01 78 25 – Facility Startup/Commissioning: Report Forms and Schematics.

.3 Pump performance curves (family of curves).

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from Site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASME

.1 ASME B16.22-22, Wrought Copper, and Copper Alloy Solder - Joint Pressure Fittings.

.2 ASME B16.24-2021, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.

.3 ASME B16.26-2018, Cast Copper Alloy Fittings for Flared Copper Tubes.

.4 ASME B31.5-2022, Refrigeration Piping and Heat Transfer Components.

.2 ASTM International

.1 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.2 ASTM B280-2020, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 CSA Group

.1 CSA B52:18, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.1 EPS 1/RA/1-2015, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning on-site installation, with Consultant Representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with 01 35 29.06- Health and Safety Requirements. Indicate VOCs for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for refrigerant piping for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 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 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect refrigerant piping, fittings and equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of crates, pallets, padding, packaging materials as specified in Construction Waste Management Reduction Workplan.

2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated, and sealed.

.1 Hard copper: to ASTM B280, type ACR.

.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121degrees C.

.2 Brazed:

.1 Fittings: wrought copper to ASME B16.22.

.2 Joints: silver solder, 15% Ag-80% Cu-5%P and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ASME B16.24, Class 150, and Class 300.

.2 Gaskets: suitable for service.

.3 Bolts, nuts, and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for refrigerant piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant Representative.

.2 Inform Consultant Representative 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 Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05-Installation of Pipework.

3.4 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.5 PIPING INSTALLATION

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.

.3 Provide inverted deep trap at top of risers.

.4 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified.

.2 Small riser: size for 5.1 m^3/s at minimum load. Connect upstream of traps on large riser.

3.6 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides, respectively.

.3 Test procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.7 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13degrees C for at least 12hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14 Pa absolute and hold for 4 hours.

.2 Break vacuum with refrigerant to 14 kPa.

.3 Final to 5 Pa absolute and hold for at least 12 hours.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit test results to Consultant Representative.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements to Consultant Representative.

.9 Manufacturer's Field Services:

.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection, and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 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, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60%complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3days of review, and submit, immediately, to consultant Representative.

3.8 DEMONSTRATION

.1 Instructions:

.1 Post instructions in frame with glass cover in accordance with Section 01 78 00- Closeout Submittals and CSA B52.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11- Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASME

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2023.

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

.1 Safety Data Sheets (SDS).

1.2 RELATED REQUIREMENTS

.1 22 42 16 - Commercial Lavatories and Sinks

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer’s instructions, printed product literature and data sheets for HVAC water treatment systems and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit PDFs of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements, 01 35 43 - Environmental Procedures. Indicate VOCs for adhesive and solvents during application and curing.

.3 Shop Drawings:

.1 Submit drawings.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for HVAC water treatment systems for incorporation into manual.

.3 Include following:

.1 Log sheets as recommended by manufacturer.

1.5 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 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect HVAC water treatment systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MANUFACTURER

.1 Equipment, chemicals, and service provided by one supplier.

2.2 POT FEEDER

.1 Welded steel, pressure rating 1200 kPa. Temperature rating: 90 degrees C.

2.3 CHEMICAL FEED PIPING

.1 Resistant to chemicals employed. Pressure rating:1000 kPa.

2.4 CHEMICAL FEED PUMPS

.1 Top-mounted electronic metering diaphragm type: flow range 0-100%, adjustable, plus or minus 1.0% accuracy (repetitive), on-off operation, with pressure relief valve, check valve, foot valve, injection fitting.

2.5 SHIPPING/FEEDING CHEMICAL CONTAINERS

.1 High density moulded polyethylene, with liquid level graduations, cover.

2.6 CONDUCTIVITY CONTROLLER

.1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 microohms.

.2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleed off status lights.

2.7 CONDUCTIVITY PROBES

.1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

2.8 WATER TREATMENT FOR HYDRONIC SYSTEMS

.1 Glycol system: pot feeder, 19 L.

.2 Micron filter for each pot feeder:

.1 Capacity 2% of pump recirculating rate at operating pressure.

.2 Six (6) sets of filter cartridges for each type, size of micron filter.

2.9 CHEMICALS

.1 Provide 1 year supply.

2.10 TEST EQUIPMENT

.1 Provide one set of test equipment for each system to verify performance.

.2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC water treatment systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of representative of consultant.

.2 Inform representative of 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 representative of consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler and Pressure Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.4 CHEMICAL FEED PIPING

.1 Install crosses at changes in direction. Install plugs in unused connections.

3.5 CLEANING OF MECHANICAL SYSTEM

.1 Provide copy of recommended cleaning procedures and chemicals for approval by representative of consultant.

.2 Flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.

.3 Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.

.4 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.5 Disposal of cleaning solutions approved by authority having jurisdiction.

3.6 WATER TREATMENT SERVICES

.1 Provide water treatment monitoring and consulting services for period of [1 year] after system start-up. Service to include:

.1 Initial water analysis and treatment recommendations.

.2 System start-up assistance.

.3 Operating staff training.

.4 Visit plant every 7 days during period of operation and as required until system stabilizes and advise on treatment system performance.

.5 Provide necessary recording charts and log sheets for 1 year operation.

.6 Provide necessary laboratory and technical assistance.

.7 Provide clear, concise, written instructions and advice to operating staff.

3.7 WATER SOFTENER

.1 Install in accordance with manufacturer’s instructions.

.2 Install water meter in water softener inlet piping.

3.8 FIELD QUALITY CONTROL

.1 Start-up:

.1 Startup water treatment systems in accordance with manufacturer’s instructions.

.2 Commissioning:

.1 Commissioning Agency: to be installing water treatment sub-contractor.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After start-up and before TAB of connected systems.

.3 Pre-commissioning Inspections: verify:

.1 Presence of test equipment, reagents, chemicals, details of specific tests performed, and operating instructions.

.2 Suitability of logbook.

.3 Currency and accuracy of initial water analysis.

.4 Required quality of treated water.

.4 Commissioning procedures - applicable to Water Treatment Systems:

.1 Establish, adjust as necessary and record automatic controls and chemical feed rates.

.2 Monitor performance continuously during commissioning of connected systems and until acceptance of project.

.3 Establish test intervals, regeneration intervals.

.4 Record on approved report forms commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.

.5 Establish, monitor, and adjust automatic controls and chemical feed rates, as necessary.

.6 Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).

.7 Advise representative of consultant in writing on matters regarding installed water treatment systems.

.5 Commissioning procedures - Water Softeners:

.1 Demonstrate compliance with specifications by chemical analyses of raw water and treated water.

.2 Determine, demonstrate actual softening capacity between regenerations.

.3 Establish regeneration intervals and procedures.

.4 Train O&M personnel in regeneration procedures.

.6 Commissioning procedures - Closed Circuit Hydronic Systems:

.1 Analyze water in system.

.2 Based upon an assumed rate of loss approved by representative of consultant, establish rate of chemical feed.

.3 Record types, quantities of chemicals applied.

.7 Training:

.1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

.2 Train O&M personnel in softener regeneration procedures.

.8 Certificates:

.1 Upon completion, furnish certificates confirming satisfactory installation and performance.

.9 Commissioning Reports:

.1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, other data required by representative of consultant.

.10 Commissioning activities during Warranty Period:

.1 Check out water treatment systems on regular basis and submit written report to representative of consultant.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.2 ASTM International

.1 ASTM A480/A480M-22, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

.2 ASTM A635/A635M-22, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M-22, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Green Seal Environmental Standards (GS)

.1 GS-36-13, Standard for Adhesives for Commercial Use.

.4 National Fire Protection Association (NFPA)

.1 NFPA 90A-21, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-21, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-21, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

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

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2020.

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

.3 IAQ Guideline for Occupied Buildings Under Construction 2008.

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168-A2022, Adhesives and Sealants Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittals.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in BC, Canada.

.4 Test and Evaluation Reports:

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

.3 Class C: transverse joints and connections made airtight with sealant. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: in accordance with Section 07 92 00- Sealants.

.2 Adhesives and sealants: VOC limit 30 g/L maximum to SCAQMD Rule 1168.

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

2.3 DUCT LEAKAGE

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

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius, centreline radius: 1.5 times width of duct.

.2 Round: smooth radius, centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400mm: with single thickness turning vanes.

.2 Over 400mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degrees entry on branch.

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

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

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 As indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.5 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems.

.2 Fire stopping material and installation must not distort duct.

2.6 GALVANIZED STEEL

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

.2 Thickness, fabrication, and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.7 HANGERS AND SUPPORTS

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

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

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

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6

751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Engineer.

.2 Inform the Engineer 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 the Engineer.

3.2 GENERAL

.1 Do work in accordance with SMACNA.

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

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

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

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

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

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

.3 Hanger spacing in accordance with as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Room Fresh air intake.

.2 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

3.5 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.6 LEAKAGE TESTS

.1 Refer to Section 23 05 94- Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete test before performance insulation or concealment Work.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2020.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 GENERAL

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

.2 Access doors in ducts, Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.3 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fiber insulation.

.4 Gaskets: neoprene.

.5 Hardware:

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

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

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

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

.5 Hold open devices.

.6 300 x 300 mm glass viewing panels.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.0375 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

2.3 TURNING VANES

.1 Factory or shop fabricated single thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.4 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

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

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.5 SPIN-IN COLLARS

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

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

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer.

.2 Inform the engineer 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 the engineer.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

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

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

.3 As indicated.

.2 Length of connection: 100 mm.

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

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

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

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 300 x 300 mm for viewing.

.2 As indicated.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

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

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.2 For temperature readings:

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2020.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.4 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

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

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.

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

.4 Inside and outside bronze end bearings.

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

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured material compatible with ducts.

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

.3 Maximum blade height: as indicated.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

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

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Engineer.

.2 Inform the Engineer 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 the Engineer.

3.2 INSTALLATION

.1 Install where indicated.

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

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

.7 Corrections and adjustments conducted by the Engineer.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s 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 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed or parallel blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Performance:

.1 Leakage: in closed position less than 2% of rated air flow at 500Pa differential across damper.

.2 Pressure drop: at full open position less than 25Pa differential across damper at 10m/s.

.6 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, single leaf, aluminum construction with nylon bearings, center pivoted.

2.3 RELIEF DAMPERS

.1 Motorized multi-leaf aluminum dampers with ball bearing center pivoted and counterweights set to open at as indicated.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer.

.2 Inform the engineer 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 the engineer.

3.2 INSTALLATION

.1 Install where indicated.

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

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 National Fire Protection Association (NFPA)

.1 NFPA 90A-21, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112-10(R2021), Standard Method of Fire Test of Fire Damper Assemblies.

.2 CAN/ULC-S112.2-07(R2021), Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.2 Indicate the following:

.1 Fire dampers.

.2 Fire stop flaps.

.3 Operators.

.4 Fusible links.

.5 Design details of break-away joints.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for fire and smoke dampers for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Procedures.

.2 Provide:

.1 6 fusible links of each type.

1.5 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect fire and smoke dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type A, listed and bear label of ULC, meet requirements of NFPA 90A and authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire dampers: 1-1/2-hour fire rated unless otherwise indicated.

.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, guillotine type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in the manufacturer's instructions for fire dampers shall be followed.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in presence of the engineer.

.3 Inform the engineer of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the engineer.

3.2 INSTALLATION

.1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Installation of fire stopping in accordance with architectural specifications.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-21, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-21, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

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

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2020

.4 Underwriters' Laboratories (UL)

.1 UL 181-2013, Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S110-2018, Standard Methods of Tests for Air Ducts.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.2 Indicate:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

.3 Test and Evaluation Reports:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect flexible ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Type 1: spiral wound flexible aluminum.

.2 Performance:

.1 Factory tested to 1000 Pa without leakage.
.2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

.1 Type 2: spiral wound flexible aluminum with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl or reinforced mylar/neoprene laminate jacket.

.2 Performance:

.1 Factory tested to 1000 Pa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.3 Thermal loss/gain: 1.3 W/m2.0C mean.

2.4 NON-METALLIC - INSULATED

.2 Non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fiber thermal insulation with vapor barrier and reinforced mylar/neoprene laminate jacket, as indicated.

.3 Performance:

.1 Factory tested to 1.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.5 NON-METALLIC - UNINSULATED

.1 Type 3: non-collapsible, coated mineral base fabric or aluminum foil mylar type, mechanically bonded to, and helically supported by, external steel wire.

.2 Performance:

.1 Factory tested to 1000 Pa without leakage.

.2 Maximum relative pressure drop coefficient: 3

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for flexible ducts installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer.

.2 Inform the engineer 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 the engineer.

3.2 DUCT INSTALLATION

.1 Install in accordance with: NFPA 90A and NFPA 90B SMACNA.

.2 Do leakage test in accordance with Section 23 05 94 - Pressure Testing of Ducted Air System.

.3 Do trial test to demonstrate workmanship.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA Standard 99-2016, Standards Handbook.

.2 ANSI/ASHRAE 51-16 (ANSI/AMCA 210-16), Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

.3 ANSI/AMCA Standard 300-2014, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Standard 301-2022, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings.

.2 Provide:

.1 Fan performance curves showing point of operation, bhp and efficiency.

.2 Sound rating data at point of operation.

.3 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers and as appropriate.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Submit in accordance with Section 01 78 00 - Closeout Procedures.

1.4 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. Storage and Handling Requirements:

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

.2 Store and protect HVAC fans from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

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

.2 Capacity: flow rate, total static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2.2 PERFORMANCE CRITERIA

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

.1 Capacity: flow rate, static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

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

.3 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Provide unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.5 HVAC Fans: ENERGY STAR certified.

2.3 FANS GENERAL

.1 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 For use with variable speed controllers.

.3 Sizes see mechanical equipment schedule.

.4 Motor enclosure to be class 1 division 2 explosion proof type, see mechanical schedules.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, dampers and vanes and as indicated.

.3 Factory primed before assembly in color standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.6 Vibration isolation

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

.8 Fan characteristics and construction: as centrifugal fans.

.9 Cabinet hung single or multiple wheels with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard inside/outside casing.

.10 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to MPI #18. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 50 mm thick rigid acoustic insulation, pinned and cemented, complete with perforated metal liner.

2.4 CENTRIFUGAL FANS (UPBLAST)

.1 Fan wheels:

.1 Welded aluminum construction.

.2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.

.2 Curb model: UG12, heavy-gauge steel with welded corner seams, cover 40mm (1.5”) thick 1.36kg(3lb) density fiberglass insulation.

.3 Aluminum curbs 12” high come with the fan manufacturer.

.4 Drive type: B belt, with back draft damper Motor speed constant 1800rpm, services switches: NEMA 4, AMCA C spark resistance.

.5 UL/ETL listing UL705, V-belt drive kit: adjustable drive kit.

.6 Inlet outlet guard /screens: bird screen.

.7 Direct drive motors include overload protection.

2.5 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

2.6 CEILING FANS

.1 UV resistant hybrid resin construction, stainless steel retention cables secure and stabilize airfoils.

.2 High efficiency brushless EC motor, sealed bearings and electronics.

.3 UL wet rated for outdoor use IP 56.

.4 Sound level <35dBA at max speed.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer

.2 Inform the engineer 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 the engineer.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drops.

.5 Neck velocity.

1.2 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Procedures.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

1.3 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect diffusers, registers and grilles from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

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

2.2 GENERAL

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

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames as specified.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Color: as indicated

2.3 MANUFACTURED UNITS

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

2.4 SUPPLY GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

.2 Paint finish: Baked-on powder coat finish.

.1 The paint film thickness shall be a minimum of 2 mils.

.2 The finish shall have a hardness of 2H as tested in accordance with ASTM D3363.

.3 The finish shall pass an ASTM B117 Corrosive Environment Salt Spray Test for 1000 hours with no measurable creep, rusting or blistering as per ASTM D1654, D610 and D714.

.4 The finish shall pass an ASTM D870 Water Immersion test of a minimum of 500 hours with no measurable with no rusting or blistering as per ASTM D610 and D714.

.5 The finish shall have an impact resistance of 100 inch-pounds in accordance with ASTM D2794.

.3 SG-1: 520D.

.1 Steel construction, single deflection louver type. Two sets of fully adjustable blades with 3/4 inch on center blade spacing. 3/8" flat border mounting frame, counter sunk screw holes complete with screws.

.2 Front blades parallel to the long dimension.

.4 SG-2: SPD. 600mmx600mm square plaque diffuser.

.1 Diffusers shall be steel construction, and shall consist of a seamless, one-piece, precision formed back pan that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

.2 An inner plaque assembly shall be incorporated and shall drop no more than ¼ inch below the ceiling plane to assure proper air distribution performance.

.3 The inner plaque assembly shall be completely removable from the room side to allow for full access to any dampers or other ductwork components located near the diffuser neck.

.4 The diffuser shall integrate with all duct sizes shown on the plans without affecting the face size and appearance of the unit.

.5 The face panel shall have smooth edges and rounded corners to blend with the back cone.

.6 The diffuser ceiling module size shall be 600mmx 600mm (24 x 24 inches).

.7 Shall be supplied with a steel volume control damper.

.5 SG-3, 610. Aluminum Louvered Supply Grille

.1 Grilles shall be single deflection louver type.

.2 One set of fully adjustable blades, with 3/4 inch on center blade spacing.

.3 The grilles front blade orientation shall be front blades parallel to the long dimension.

.4 The blades and border shall be aluminum construction

.5 Coated aluminum blade damper, 32mm flat border,3/8" flat border mounting frame. Counter sunk screw holes.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 RG-1, EG-1. 80- egg crate grille.

.1 Shall be supplied with a cubical grid core, used as a high-capacity return or exhaust outlet with high free area and low sound and pressure drop.

.2 Grilles shall be aluminum construction, consisting of an extruded aluminum border: aluminum ½ x ½ x ½ inch grid egg crate core.

.2 EG-2, 630. Aluminum Louvered Supply Grille

.1 Grilles shall be single deflection louver type, and shall have:

.2 One set of fully adjustable blades, with 3/4 inch on center blade spacing.

.3 The grilles front blade orientation shall be front blades parallel to the long dimension.

.4 The blades and border shall be aluminum construction

.5 Coated aluminum blade damper, 32mm flat border,3/8” flat border mounting frame. Concealed bracket.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Engineer.

.2 Inform the Engineer 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 the Engineer.

3.2 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

.3 Provide concealed safety chain on each grille, register and diffuser in elsewhere as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 National Fire Protection Association (NFPA)

.3 National Research Council Canada (NRC)

.1 National Building Code of Canada 2020 (NBC).

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

.5 Society of Automotive Engineers (SAE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittals.

.2 Product Data:

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

.2 Indicate following:

.1 Pressure drops.

.2 Face area.

.3 Free area.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.3 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 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

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

2.2 GOOSENECK HOODS

.1 Thickness: to SMACNA.

.2 Fabrication: to SMACNA.

.3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be a class A seal.

.4 Supports: as indicated.

.5 Complete with integral bird screen of 2.7 mm diameter aluminum wire. Use 12 mm mesh on exhaust and intake.

.6 Horizontal backdraft dampers

2.3 FIXED LOUVRES - ALUMINUM

.1 E.H Price DE439. 39 degree extruded blade with durable louver.

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

.3 Material: extruded aluminum alloy 6063-T5.

.4 Blade: stormproof pattern with center watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.5 Frame, head, sill, and jamb: 100 mm deep one-piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.6 Mullions: at 1500 mm maximum centers.

.7 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.8 Screen: 12 mm exhaust and 19 mm intake mesh, 2 mm diameter wire aluminum bird screen on inside face of louvres in formed U-frame.

.9 Finish: mill finish color: to the engineer's approval.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes, and vents installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the engineer.

.2 Inform the engineer 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 the engineer.

3.2 INSTALLATION

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

.2 Reinforce and brace as indicated.

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

.4 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.2 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Indicate following:

.1 Methods of sealing sections.

.2 Methods of expansion.

.3 Details of thimbles.

.4 Bases/Foundations.

.5 Supports.

.6 Guy details.

.7 Rain caps.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial/Territorial regulations.

.2 Certifications:

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to Construction Work Area in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect chimneys and stacks from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 REGULATORY REQUIREMENTS

.1 Exhaust ventilation systems to comply with ANSI/ASHRAE 62.1.

.2 Install breechings, chimneys, and stacks in accordance with the following standards:

.1 CSA B149.1

.2 CSA B365

.3 ULC S628

2.2 VENTS FOR HOT WATER HEATERS AND CONDENSING BOILERS

.1 Approved vent/intake pipe material: ULC S636 PVC/CPVC

.1 PVC material

- DWV ASTM-D2665 or CSA B181.2
- Schedule 40,80, 120 ASTM-D1785 or CSA B137.3
- SDR series ASTM-D2241 or CSA B137.3

.2 CPVC material

- CPVC 41 ASTM-D2846 or CSA B 137.6
- Schedule 40,80 ASTM-F441 or CSA B137.6
- SDR series ASTM-F442.

2.3 VENT FOR INFRARED HEATERS

.1 Inside building: stainless steel single wall vent.

.2 When penetrate wall or roof: stainless steel double wall B vent.

2.4 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Barometric dampers: single or double acting, 70% of full size of breeching area, as recommended by manufacturer.

.3 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA).

.4 Rain cap.

.5 Expansion sleeves with heat resistant caulking, held in place as indicated.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Agreements are acceptable for chimney and stack installation in accordance with manufacturer's written instructions.

.1 Notify representative of consultant for visual inspection of substrate.

.2 Inform representative of 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 representative of consultant.

3.2 INSTALLATION - GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at 1.5 m centres and at each joint.

.3 Support chimneys at bottom, roof and intermediate levels as indicated.

.4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.5 Install flashings on chimneys penetrating roofs, as indicated.

.6 Install rain caps and cleanouts, as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Boiler Manufacturers Association (ABMA)

.2 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2021.

.3 CSA Group (CSA)

.4 CAN/CSA-C22.2 NO.165-17(R2022) Electric Boilers.

.5 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.6 Product Data:

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

.7 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta.

.2 Indicate on drawings:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Controls.

.7 All miscellaneous equipment.

.3 Engineering data to include:

.1 Design capacity, heating input/ output, electric power consumption, electrical requirements, dimensions, weight, piping connections size.

.2 Radiant heat loss at 100% design capacity.

.8 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for heating boilers for incorporation into manual.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: Work to be performed in compliance with applicable Provincial regulations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra materials:

.1 Maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.1 Special tools for access opening, handholes and Operation and Maintenance.

.2 Spare parts for 1 year of operation.

.3 Spare gaskets.

.4 Spare gauge glass inserts.

.5 Probes and sealants for electronic indication.

.6 Safety valve test gauge.

1.5 DELIVERY, STOEAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect boiler and equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 GENERAL

.1 Packaged boiler:

.1 Complete with necessary accessories and controls.

.2 Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance with, CAN/CSA-C22.2 NO.165-17 and witnessed and certified by representative of client.

.3 Ready for attachment to piping, electrical power, controls.

.4 5 to 1 turndown ratio.

.5 Fuel: natural Gas.

.6 Come with TACO recirculation pump.

.2 Performance:

.1 In accordance with American Boiler Manufacturers Association (ABMA)

.2 Heating water: 50% P. glycol.

.3 AFUE 95%.

.3 Electrical:

.1 Power: 120/1/60.

.2 Electrical components: CSA approved.

.4 Controls: factory wired. Enclosed in EEMAC 1 steel cabinet.

.5 Thermal insulation:

.1 50 mm thick mineral fiber. Seal insulation at handholes, access opening, mudholes, piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.

.6 Jackets: heavy gauge metal, finished with heat resisting paint.

.7 Mounting: Wall mounted.

.8 Supply for installation by other Divisions. Start-up, instruction, on-site performance tests: 3 days per boiler.

.9 Trial usage:

.1 Mechanical contractor may use boilers for test purposes prior to acceptance and commencement of warranty period.

.2 Supply labor, materials and instruments required for tests.

.10 Temporary use by contractor:

.1 Contractor may use boilers only after written approval from representative of client.

.2 Monitor and record performance continuously. Keep log of maintenance activities carried out.

.3 Refurbish to as-new condition before final inspection and acceptance.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heating boiler installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of representative of consultant.

.2 Inform representative of 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 representative of consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install in accordance with ASME Boiler and Pressure Vessels Code, regulations of Northwest Territories having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing, and maintenance without disruption of operation of any other equipment/system.

.4 Pipe hot water relief valves full size to nearest glycol fill tank.

3.4 MOUNTINGS AND ACCESSORIES

.1 Safety valves and relief valves:

.1 Run separate discharge from each valve.

.2 Terminate discharge pipe as indicated.

.3 Run drainpipe from each valve outlet and drip pan elbow to above nearest drain.

.2 Blowdown valves:

.1 Run discharge to terminate as indicated.

3.5 FIELD QUALITY CONTROL

.1 Commissioning:

.1 Manufacturer to:

.1 Certify installation.

.2 Start up and commission installation.

.3 Carry out on-site performance verification tests.

.4 Demonstrate operation and maintenance.

.2 Provide MCM at least 24 hours' notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

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

.1 ASHRAE 84-2020, Method of Testing Air-to-Air Heat/Energy Exchangers (ANSI approved).

.2 National Energy Code of Canada for Building (NECB) – 2020

.3 ANSI/AHRI 1060 – Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.

.4 ANSI/AMCA 300 – Reverberant Room Method for Sound Testing of Fans.

.5 ASHRAE 84 – Method of Testing Air-to-Air Heat Exchangers.

.6 ASTM A653 – Standard Specification for Steel Sheet, G90 Zinc-Coated (Galvanized) by the Hot-Dip Process.

.7 CSA C22.2, No. 77 – Motors with Inherent Overheating Protection.

.8 CSA C22.2, No. 100 – Motors and Generators.

.9 CSA C22.2, No. 113 – Fans and Ventilators.

.10 CSA C22.2, No. 236 – Heating and Cooling Equipment.

.11 ISO 9001:2008 – Quality Management Systems – Requirements.

.12 NFPA 70 – National Electrical Code (NEC).

.13 UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

.14 UL 900 – Standard for Air Filter Units.

.15 UL 1004-1 – Standard for Rotating Electrical Machines - General Requirements.

.16 UL 1004-2 – Standard for Impedance Protected Motors.

.17 UL 1004-3 – Standard for Thermally Protected Motors.

.18 UL 1004-7 – Standard for Electronically Protected Motors.

.19 UL 1812 – Standard for Ducted Heat Recovery Ventilators.

.20 UL 2111 – Standard for Overheating Protection for Motors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings in accordance with Section 01 33 00 – Submittals.

.2 Indicate following:

.1 Overall unit dimensions and operating weight.

.2 Intake and Exhaust duct connection sizes.

.3 Total supply/exhaust airflow, external and total static pressure.

.4 Heating coil performance data - Entering and leaving air temperature, air side pressure drop, heating fluid with 50% PG, entering and leaving water temperature and water pressure drop.

.5 Supply/exhaust fan performance data - Quantity, motor size, power requirements and complete with fan curves indicating operating point.

.6 Heat recovery performance - Entering outdoor air temperature, leaving supply air temperature, entering, and leaving exhaust air temperature. Heat recovered and heat recovery efficiency.

.7 Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.

.4 Manufacturer’s Certification: Submit manufacturer’s certification that energy recovery ventilators comply with specified requirements and are suitable for intended application.

.5 Test Reports:

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

.2 Provide confirmation of testing.

.6 Manufacturers' Instructions: submit manufacturer's installation instructions.

.1 Subcontractor will make available 1 copy of systems supplier's installation instructions.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit manufacturer’s operation and maintenance manual; including the following:

.1 Operation, maintenance, adjustment, and cleaning instructions.

.2 Troubleshooting guide.

.3 Parts list.

.4 Electrical wiring diagrams.

.3 Provide detailed information required for Owner to properly operate and maintain equipment.

.4 Extra Materials:

.1 Furnish list of individual manufacturer's recommended spare parts for equipment include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.2 List of specialized tools necessary for adjusting, repairing, or replacing.

.3 Provide one set of filters for start-up and commissioning operation, and one set of filters for replacement before handover of the facility.

.5 Warranty Documentation: Submit manufacturer's standard warranty

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to Construction Work Area in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Keep materials in manufacturer's original, unopened containers and packaging until installation.

.3 Protect materials during storage, handling, and installation to prevent damage.

.4 Store and protect energy recovery equipment from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Warranty Period: 3 years.

2 Products

2.1 GENERAL

.1 Comply with ASHRAE 84.

2.2 ENERGY RECOVERY VENTILATORS

.1 Energy Recovery Ventilators: "Topvex FR Series".

.1 Model: Topvex FR800HW-208-3-CAV.

.2 Indoor, compact, commercial, air handling units.

.3 Specifier Notes: Specify type of re-heat coil.

.4 Re-Heat Coil: 50% P.glycol.

.5 Airflow Control: Constant air volume or Variable air volume

.2 General

.1 Each Unit or Group of Units: Capable of operating in any mode independently or dependently of other systems.

.2 Capable of changing modes with no interruption to system operation.

.3 Listed under CSA C22.2, No. 113/UL 1812.

.4 Wiring: NFPA 70.

.5 Performance: As scheduled on the Drawings.

.6 Equip with control systems.

.7 Perform all functions necessary for operation.

.8 Ventilation to Building: Not to cease in any mode based solely on operational temperature of minus 13 to 104 degrees F (minus 25 to 40 degrees C).

.9 Surrounding Sound Power Rating: Not higher than 75 dB(A).

.10 Sound Data: Measured in accordance with AMCA 300.

.11 Capable of operating at normal condition with specific fan power (SFP) lower than 0.9 W/cfm (2.35 kW/m3/s).

.12 Capable of operating in winter and summer conditions without imbalance or loss of ventilation capacity greater than specified in design.

.3 Unit Cabinet

.1 Cabinet Exterior: 20-gauge sheet steel, ASTM A653 – G90 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized).

.2 Double-Wall Cabinet Interior:

.1 20-gauge sheet galvanized steel, G90.

.2 Seams: Sealed, requiring no caulking in field.

.3 Insulation within Double Wall:

.1 1.5-inch (38-mm) fiberglass.

.2 Flame Spread Index, UL 723: Not over 25.

.3 Smoke Developed Index, UL 723: Not over 50.

.4 Provisions for field installed pre-heater system.

.4 Fans

.1 Direct-drive, backward-inclined, motorized impellers.

.2 Fan Motors:

.1 Maintenance-free, permanently lubricated, sealed ball bearings.

.2 Thermal overload protected (TOP).

.3 UL listed to UL 1004-1, 1004-2, 1004-3, 1004-7 and/or UL 2111; CSA C22.2, No. 77, and No.100.

.4 IP Protection: Class 44 or 54.

.5 Electronically commutated “EC” to maximize efficiency at different speeds.

.6 Mounted for quiet operation.

.3 Separate fans for exhaust and supply blowers.

.5 Energy Recovery Wheel:

.1 Rotor Matrix: Corrosion-resistant aluminium alloy, composed of alternating corrugated and flat, continuously wound layers of uniform width that guarantee laminar air flow and low static pressure loss.

.2 Counter-flow construction type.

.3 Free cooling capacity.

.4 Performance: Certified and listed by AHRI.

.5 Rotor Wheel: 8-inch-thick wheel welded at hub and perimeter to prevent uneven run-out during normal operations.

.6 Corrugated Surfaces: Coated with thin, non-migrating, adsorbent, Zeolite particles.

.7 Effectiveness of Wheel: Documented in accordance with ASHRAE 84 and AHRI 1060.

.8 Flame Spread Index, Energy Recovery Wheel, UL 723: Not over 25.

.9 Smoke Developed Index, Energy Recovery Wheel, UL 723: Not over 50.

.6 Air Filters:

.1 Fresh air protected by MER13 pockets filter constructed to meet UL 900.

.2 Exhaust air protected by MER9 pockets filter constructed to meet UL 900.

.3 Individual Pockets: Assembled into galvanized steel header providing rigid support to filter.

.4 Pre-heated air protected by stranded aluminium mesh, not shedding, or affected by humidity.

.5 Adjustable Monitoring System: Activates alarm through main controller when pressure drop increase through supply or exhaust filters.

.7 Temperature Sensors: Four stainless steel temperature sensors for monitoring supply and exhaust air in and air out, maximizing units efficiency and detecting need for frost prevention.

.8 Hot Glycol Coil:

.1 Aluminum plate fins on copper tubing.

.2 Heat Control: Operated by 0 to 10 V signal activated by unit's main controller.

.3 Frost Protection Sensor: Activates alarm if frost occurs.

.9 Hot Glycol Coil:

.1 Enables unit to perform in extremely cold climates to preserve performance and ensure continuous supply of air.

.2 Designed to keep temperature above frost threshold, while remaining within temperature range of unit.

.3 Aluminum plate fins on copper tubing.

.4 Heat Control: Operated by 0 to 10 V signal activated by unit's main controller.

.5 Frost Protection Sensor: Activates alarm if frost occurs.

.10 Electrical 3 phase input voltage:

.1 Electrical Power: 208-230 VAC, 3 phase, 60 Hz with neutral line.

.2 Internal Electrical Components: Factory wired for single-point power connection.

.3 Electrical Box Components: Accessible without stopping unit or opening doors.

.4 Electrical Box:

.1 Isolated from airflow paths.

.2 Protect integral wires and connections.

.5 Controlled by integral microprocessor controller.

.11 Serviceability:

.1 Access Panel: Hinged and/or screwed access panel on bottom of unit.

.2 Energy Recovery Wheels, Filters, and Motors: Serviceable from front of unit.

.3 Fan Assemblies: Mounted on removable base.

.4 Energy Recovery Wheels and Filters: Mounted on slide-out rails.

2.3 CONTROLS

.1 General:

.1 Corrigo: Capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, integrated web-based interface, graphical user workstation, and system integration to Building Management Systems via Native BacNET, Modbus via RS 485, Exoline, built-in web, and TCP/IP.

.2 Digital wall controller display.

.3 Controller Communications: Via common non-polar communications bus.

.4 Control Wiring: Installed in system daisy-chain configuration from unit to BAS controller and to other units, if applicable.

.5 Network Wiring: CAT-5e with RJ-45 connection.

.2 Integration with Building Management Systems:

.1 Corrigo in EXO4 System: Equipped with RS485 port for bus communication via EXOline or Modbus. Enables controller to be directly integrated with EXO4, Regin SCADA system.

.2 Corrigo Web in a network:

.3 Corrigo directly integrated with foreign SCADA system via Modbus:

.4 Corrigo integrated with foreign SCADA system via Regin EXOopc Driver:

.5 Corrigo Connected to Foreign Protocols:

.6 Controller: Handle BACnet, Johnson, Trend, and other foreign protocols via EXO communicator.

.7 Corrigo connected to BACnet system.

.8 Schedule Timer:

.1 Corrigo: Year-base clock function. Weekly schedule with holiday periods for full year can be set.

.2 Clock:

- Automatic summertime/wintertime change-over, individual schedules for each weekday, and separate holiday setting.
- Up to 24 individual holiday periods configurable.
- Holiday Period: Anything from 1 day up to 365 days.
- Holiday Schedules: Take precedence over other schedules.
- Each Day: Up to 2 individual running periods.

.3 Pressure Controlled Fans: Daily individual schedules for normal speed and reduced speed, each with up to 2 running periods.

.4 Up to 5 digital outputs available as timer-controlled outputs. Each with individual week schedules with 2 activation periods per day.

.3 Graphical User Workstation Software:

.1 E Tool: PC-based configuration software with graphical user interface.

.2 Program: Overview of Corrigo E settings.

.3 Using E Tool, all settings configured on PC and downloaded into controller.

.4 Infinite number of configurations stored in computer memory for later use.

2.4 ASSEMBLY

.1 Factory assembled and wire energy recovery ventilators.

2.5 ACCESSORIES

.1 Hydronic Re-Heat: Model HWC.

.2 Hydronic Pre-Heat: Model WPR.

.3 Sliding Door Kit: Model SDF.

.4 Shut-Off Damper: Model EFD and Model AF24 motor.

.5 Temperature Sensor (minus 40 to 60 degrees C/IP65): Model TG-UH/PT1000.

2.6 SOURCE QUALITY CONTROL

.1 Run test at factory.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Agreements are acceptable for energy recovery equipment installation in accordance with manufacturer's written instructions.

.1 Notify representative of consultant for visual inspection of substrate.

.2 Inform representative of 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 representative of consultant.

3.2 PREPARATION

.1 Prepare surfaces where energy recovery ventilators are to be mounted.

.2 Ensure surfaces are flat, level, plumb, and can support weight of energy recovery ventilators.

3.3 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

.3 Install energy recovery ventilators in accordance with NFPA 70.

.4 Install energy recovery ventilators level, plumb, and secure.

.5 Do not expose electronic components to temperatures below 32 degrees F (0 degrees C) or above 122 degrees F (50 degrees C).

.6 Install duct configuration horizontal from top of unit to minimize height of installation.

.7 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers.

3.4 ADJUSTING

.1 Adjust energy recovery ventilators for proper operation in accordance with manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

.1 Tests:

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 DEMONSTRATION

.1 Demonstration:

.1 Demonstrate that energy recovery ventilators function properly in every respect.

.2 Perform demonstration at final system inspection by factory-trained and certified representative of manufacturer.

.2 Instruction and Training:

.1 Provide instruction and training of Owner's personnel as required for operation and maintenance of energy recovery ventilators.

.2 Provide hands-on demonstrations of operation of system components and complete system, including user-level program changes and functions.

.3 Provide instruction and training by factory-trained and certified representative of manufacturer.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):

.1 ANSI/AHRI 210/240-2023(2020), Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

.2 AHRI 270-2015, Sound Rating of Outdoor Unitary Equipment

.2 ASTM International (ASTM):

.1 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus

.3 Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)):

.1 AAMA 2604-21, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

.2 AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

.4 ULC Standards (ULC):

.1 CAN/ULC-S111-13(R2018), Standard Method of Fire Tests for Air Filter Units

.5 Canadian Roofing Contractors Association (CRCA):

.1 CRCA Roofing Specifications Manual, (Latest version)

.6 CSA Group (CSA):

.1 CSA C22.1-21, Canadian Electrical Code, Part I ([24th] edition), Safety Standard for Electrical Installations

.2 CSA C22.2 No.236-15, Heating and Cooling Equipment (Bi-national standard with UL 1995)

.7 National Fire Protection Association (NFPA):

.1 NFPA 90A-21, Standard for the Installation of Air-Conditioning and Ventilating Systems

.8 Underwriters Laboratories (UL):

.1 UL 1995-15, Standard for Heating and Cooling Equipment

1.2 ABBREVIATIONS AND ACRONYMS

.1 DBT: Dry bulb temperature

.2 DX: Direct expansion

.3 OAD: Outside air damper

.4 PV: Performance verification

.5 SA: Supply air

1.3 RELATED REQUIREMENTS

.1 Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Submit manufacturer's instructions, product data for outdoor HVAC equipment and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Submit drawings.

.2 Drawings to indicate project layout and dimensions, including:

.1 Equipment, piping, connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries, and hardware.

.2 Size and recommended bypass connections for recommended ancillaries, which are mounted, wired and piped ready for final connection to building system.

.3 Piping, valves, and fittings shipped loose showing final location in assembly.

.4 Control equipment shipped loose, showing final location in assembly.

.5 Complete internal and external schematics and assembly of [pneumatic tube piping] [wiring].

.6 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes, and location of mounting bolt holes; include mass distribution drawings showing point loads.

.7 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, and controllers.

.8 Fan performance curves.

.9 Details of vibration isolation.

.10 Estimate of sound levels to be expected across individual octave bands in dB referred to as A-rating.

.4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Site Reports:

.1 Submit manufacturer's site reports as specified.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit and incorporate into manual.

.1 Indicate: Brief description of unit, indexed with details of function, operation, control, and service for components.

.2 Include unit manufacturer's name, type, year, number of units, and capacity.

.3 Submit manufacturer's warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging with manufacturer's label.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in a way that protects outdoor HVAC equipment from deformation and abrupt bumps/impact forces in accordance with manufacturer's recommendations.

.4 Packaging Waste Management: Remove pallets, padding, and packaging materials for reuse and return as specified in Construction Waste Management Plan, Waste Reduction Workplan and in accordance with Section 01 74 19 - Waste Management and Disposal.

1.7 WARRANTY

.1 Submit standard warranty.

2 Products

2.1 GENERAL

.1 Supply and install a Nagas Express model SDM direct gas-fired air heater operating on natural gas and for outdoor installation. The manufacturer must be accredited by the CWB in compliance with standard CSA W47.1 to meet the minimum standard applicable to all types of welds.

.2 Roof-mounted, self-contained single zone unit with gas burner and bearing label of CSA.

.3 Units to consist of cabinet and frame, supply fan, burner, control, air filter, and fans, motorized outside air damper.

.4 Prefabricated roof curb to ARCA manual recommendations, minimum height 450 mm.

2.2 PERFORMANCE CRITERIA

.1 As scheduled or as indicated on Drawings:

.1 Fan Capacity: 1180 L/s at 250 Pa external static pressure with 1.1kW motor.

.2 Minimum 87 kW rated heating output with a temperature rise of 61°C(110°F)

2.3 CABINET

.1 The support frame will be made of formed 14-gauge G-90 galvanized steel. The walls, roof and floor will be single wall and built with minimum 20-gauge G-90 galvanized steel panels with 2-inch thick reinforced-coated fiberglass insulating material (1.3 lb./ft3). Each panel should not exceed 20 inches wide and have 2-90o ply edges to provide structural rigidity.

.2 They will be screwed assembled together and sealed with a PVC gasket and a urethane joint for positive waterproofing and air tightness.

.3 The outer surfaces of the unit will be cleaned and oiled for a G-90 galvanized finish. Each unit section will have a lift-up access door with gaskets, screwed knob door handles to have access to every component.

.4 Controls and piping shall be installed inside a protective enclosure with full-sized lift-up access door for easy maintenance.

2.4 FANS

.1 The fan section will be designed according to the Air Movement and Control Association (AMCA) standards. The fan and motor will be installed on a steel structure welded in compliance with the CWB standards and rest on anti-vibration rubber in shear pads.

.2 A lift-up access door will provide access for maintenance of the fan, motor, bearings, belts, and pulleys. The fan will be a centrifugal forward-curved (FC) type, double width double inlet wheel (DWDI), model ATLI from Comefri with L50 200,000 hours self-aligning, single row, deep groove ball type bearings. The motor will be enclosed fan-cooled (TEFC), and EPACT rated for higher efficiency from Baldor; it will be installed on a base to enable the adjustment of the belt tension and pulleys alignment.

2.5 AIR FILTERS

.1 The filters shall be pleated large surface disposable type, 2-inch thick and 35% efficient media MERV 8, Class 2, UL rated from AAF. Filters will be mounted in galvanized steel sliding frame located in air intake hood, equipped with an access hinged panel for easy replacement.

2.6 INLET DAMPER

.1 The air inlet damper will be opposed blades standard construction in galvanized steel and equipped with 2 positions (on/off) actuator with spring return and end limit switch.

2.7 HOODS

.1 The air hoods will be “angled” type, mounted on unit end, and equipped with a 1” galvanized steel bird screen as well as rain gutters and water collection drains around its perimeter.

.2 Inlet hood air velocity shall not exceed 500 FPM.

.3 Inlet hood shall be constructed of the same materials as the unit’s exterior with a minimum 20ga G-90 galvanized steel construction. It shall also be of the same finish as the equipment for esthetical reasons (painted or galvanized).

2.8 BURNER AND GAS PIPING

.1 The burner will be Midco direct fired type, consisting of cast aluminum gas distributor and stainless diffuser baffles, factory mounted on a galvanized steel profile plate equipped with air flow adjustable plates. All gas piping and control equipment required for the proper

operation of the unit shall be factory installed and tested.

.2 The gas pilot piping will be equipped with an electronic spark igniter, manual shut-off valve, gas pressure regulator, automatic shut-off valves, manual cock and 2 pressure test port. The gas supply of the main burner will include a pressure regulator on units with a gas train of 1 inch or less, two automatic quick-closing shut-off valves, a manual ignition valve, 3 pressure test ports and a modulating gas valve. The burner and gas piping assembly will have a modulating turndown ratio of at least 25:1.

2.9 CONTROLS

.1 Terminal block for power connection

.2 Temperature control: Maxitrol 14 with temperature selector

.3 Flame safeguard with indicating lights (Fireye)

.4 Magnetic starter with overloads

.5 Air control limit

.6 Low- and high-pressure switch

2.10 CERTIFICATION

.1 All SDM direct gas fired make-up air heaters must be CSA approved and certified according to standards CAN/CSA3.7 – ANSI Z83.4.

2.11 START –UP & FACTORY ADJUSTMENT

.1 Each unit shall be fired tested and pre-adjusted at factory prior to shipment. On site start-up shall be performed by a qualified technician with appropriate cards for gas equipment and authorized by the manufacturer.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed are acceptable for outdoor HVAC equipment installation in accordance with manufacturer's instructions.

.1 Inspect substrate in presence of representative of consultant.

.2 Inform representative of 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 representative of consultant.

3.2 INSTALLATION

.1 Install per manufacturers' instructions on roof curbs provided by manufacturer.

.2 Run drain line from drain pan to discharge over roof drain.

3.3 SITE QUALITY CONTROL

.1 Manufacturer to certify installation, supervise start-up unit.

.2 Manufacturer's Site Services:

.1 Have manufacturer of products supplied under this Section review work involved with installation of its products, and submit reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's site services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Submit reports within 3 days of review to representative of consultant.

.4 Performance Verification:

.5 General:

.1 Conforms to Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

.2 Make up Air Units:

.1 Set outside air dampers.

.2 Check for smooth, correct rotation of supply fan impeller with no vibration.

.3 Measure supply fan capacity.

.4 Adjust impeller speed as necessary and repeat measurement of fan capacity.

.5 Measure DBT (dry bulb temperature), WBT (wet bulb temperature) of SA supply air.

.6 Measure flow rates of SA.

.7 Measure radiated and discharge sound power levels under maximum heating demand.

.8 Verify operating control strategies, including:

- Heat exchanger operating limit and high limit
- Early morning warm-up cycle
- Freeze protection
- Alarms
- Voltage drop across thermostat wiring
- Operation of remote panel including pilot lights, and failure modes

.3 Start-Up: Comply with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

.4 Verify clear access and serviceability of components including motorized dampers, fans, motors, operators, sensors, and electrical disconnects.

.5 Verify clear access, cleanability.

3.4 DEMONSTRATION

.1 Training: In accordance with Section 01 79 00 - Demonstration and Training of O & M personnel, as specified.

3.5 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Perform cleaning operations in accordance with manufacturer's recommendations.

.4 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Institute of Boiler and Radiator Manufacturers (IBR):

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00 - Submittal Procedures].

.2 Product Data:

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

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Equipment, capacity, piping, and connections.

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

.3 Special enclosures.

.4 Samples:

.1 Submit [1200] mm length sample enclosure showing method of securing to structure and connecting to adjacent length of enclosure.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for [finned tube radiation heaters] for incorporation into manual.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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

.2 Store and protect finned tube radiation heaters from nicks, scratches, and blemishes.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan, Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

2 Products

2.1 BASEBOARD RADIATION

.1 Heating elements: NPS 20mm (¾") copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins; one tube end belled.

.2 Enclosure: minimum 1.6 mm thick steel prefinished surface mounted with1.0 mm thick back and top of one-piece construction. Front panel removable. Run wall to wall unless otherwise indicated. Assemble with stainless steel No.10 oval head sheet metal screws. Finish factory applied baked on enamel.

.3 Element brackets: 1.2 mm thick galvanized steel to support front panel and element cradle. Space brackets 900 mm centers maximum.

.4 Provide for noiseless expansion of components.

2.2 CABINET CONVECTORS

.1 Heating element: seamless copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins and cast-iron headers, steel side plates and supports.

.2 Cabinet: type as indicated, 1.6 mm thick steel back and ends, exposed corners rounded, secured removable front panel, braced and reinforced for stiffness. Provide access doors for valves, vents, and traps. Finish cabinet with factory applied baked primer coat.

.3 Catalogue rating: certified IBR ratings.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for finned tube radiation convector heater installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of representative of consultant.

.2 Inform representative of 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 representative of consultant.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and approved shop drawings.

.3 Provide for pipe movement during normal operation.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with representative of consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow representative of consultant directive.

.6 Valves:

.1 Install valves with stems upright or horizontal unless approved otherwise.

.2 Install isolating [gate] valves on inlet and lock shield balancing valves on outlet of each unit.

.7 Venting:

.1 Install screwdriver vent on cabinet convector, terminating flush with surface of cabinet.

.2 Install automatic air vent on continuous finned tube radiation.

.8 Clean finned tubes and comb straight.

.9 Install flexible expansion compensators as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Radiant heating system.

1.2 RELATED SECTIONS

.1 Section 23 09 00 – Instrumentation and Control for HVAC.

.1 Section 23 09 33 – Electric and Electronic Control System for HVAC.

.2 Section 23 09 93 – Sequence of Operation for HVAC Controls.

.2 Section 23 21 13 – Hydronic Piping.

.3 Section 23 25 13 – Water Treatment for Closed-Loop Hydronic Systems

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/National Sanitation Foundation (NSF) International:

.1 ANSI/NSF-14 – Standard 14 Plastic Piping System Components and Related Materials.

.2 American National Standards Institute (ANSI)/Underwriters Laboratories (UL):

.1 ANSI/UL 263 - Standard for Fire Tests of Building Construction and Materials.

.3 American Society of Testing and Materials (ASTM) International (www.astm.org):

.1 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

.3 ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.4 ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.

.5 ASTM F1807 – Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing.

.6 ASTM F1960 – Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing.

.7 ASTM F2159 – Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing.

.4 Canadian Standards Association (CSA) International (www.csagroup.org):

.1 CAN/CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CAN/CSA B214 – Installation Code for Hydronic Heating Systems.

.5 Plastic Pipe Institute (PPI) (www.plasticpipe.org):

.1 Technical Report TR- 4.

.6 Underwriters' Laboratories of Canada (ULC) (www.ul.com):

.1 CAN/ULC S101 – Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC S102.2 – 2007/2010 – Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies with, and without, fiberglass insulation.

.3 CAN/ULC S115 - Standard Method of Fire Tests of Firestop Systems.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Standard grade hydrostatic pressure ratings from Plastics Pipe Institute (PPI) in accordance with TR-3 as listed in TR-4. The following standard-grade hydrostatic ratings are required:

.1 82 °C (180 °F) at 100 psi (689 kPa(100psi).

.2 23 °C (73.4° F) at 1,102 kPa(160psi).

.2 Certification of flame spread/smoke development rating of ≤25/≤50 in accordance with CAN/ULC S102.2 – 2007/2010 provided the installation meets one of the following requirements:

.1 Tubing spacing is a minimum of 200mm (8 inches) apart for the following nominal sizes (no insulation required):

- 13 mm (1/2").

.2 No spacing requirement for the following nominal sizes if tubing is wrapped with 13mm (½ inch) thick fiberglass insulation:

- 13 mm (1/2").
- 16 mm (5/8").

- 19 mm (3/4”).
- 25 mm (1”).
- 32 mm (1-1/4”).
- 38 mm (1-1/2”).

.3 Certification of flame spread/smoke development rating of ≤25/≤50 in accordance with ASTM E84 provided the installation meets one of the following requirements:

.1 No spacing requirement for the following nominal sizes if tubing is wrapped with 13mm (½ inch) thick fiberglass insulation:

- 13 mm*(1/2”).
- 16 mm (5/8”).
- 19 mm (3/4”).
- 25 mm (1”).
- 32 mm (1-1/4”).
- 38 mm (1-1/2”).

.2 Performance Requirements:

.1 Show compliance with ANSI/NSF-14.

.2 Show compliance with ASTM F877.

.3 Installed through rated walls in compliance with CAN/ULC S115-05 and ASTM E814 through certification listings with Underwriters Laboratories (UL) and Underwriters Laboratories of Canada (cUL), and Warnock Hersey (WH) – See INFO 23 (L2323) for more details:

.1 Canada: Concrete Floor/Wall or Block Wall:

- cUL System No. C-AJ-2030C – max rating: F = 2h; FH = 2h.
- cUL System No. C-AJ-2061b – max rating: F = 2h; FH = 2h.
- WH System No. PHV 120-11 – max rating: F = 2h; FH = 2h.

1.5 SUBMITTALS

.1 Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

.2 Product Data:

.1 Provide manufacturer's product submittal data and installation instructions.

.3 Shop Drawings:

.1 Provide calculations that support the performance requirements of the hydronic radiant system. Indicate the type of slab construction and tubing depth relative to the exposed surface. Calculations must show the required flow rate, operating temperatures and pressure drops.

.2 Provide drawings showing tubing layouts, fixing details, tubing details, and manifold locations of all areas where hydronic radiant systems are indicated. Indicate all pumps, valves, and other components that are required to operate the hydronic radiant system specified in the sequence of operations.

.3 Provide a schedule of manifolds listing loop lengths, tubing diameter, flow rate, operating water temperatures, and head loss to meet the required performance. Cross reference to product data.

.4 Provide a schedule of valves, pumps, and other components listing the number, model, and size. Cross reference to product data.

.5 Provide product and performance data for each component.

.6 Provide details for tubing crossing concrete expansion joints.

.7 Provide sequence of operation and control device requirements as specified in related Instrumentation and Control for HVAC sections.

.4 Quality Assurance/Control Submittals:

.1 Test Reports:

.1 Upon request, submit test reports from recognized testing laboratories.

.2 Qualifications:

.1 Provide proof of qualifications when requested by consultant.

.5 Closeout Submittals:

.1 Warranty documents specified herein.

.2 Operation and maintenance data.

.3 Final as-built pipe and tubing layout drawing, indicating manifold locations, manifold schedule.

1.6 QUALITY ASSURANCE

.1 Qualifications

.1 Use installers having experience in performing work of this section that specialize in work similar in complexity and scope required for this project.

.2 Installer will use skilled tradesmen holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades professional.

.3 A qualified contractor has to have a minimum of 5 years' similar projects experience.

.2 Pre-installation

.1 Verify project requirements, floor coverings, and substrate.

.2 Verify areas of responsibility with other trades.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Comply with Division 1 Product Requirement Section.

.2 Comply with manufacturer’s ordering instructions and lead-time requirements to avoid construction delays.

.3 Delivery:

.1 Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

.4 Storage and Protection:

.1 Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

.2 Store PEX tubing in cartons or under cover to avoid dirt or foreign material from being introduced into the tubing.

.3 Do not expose PEX tubing to direct sunlight for an extended period of time. If construction delays are encountered, provide cover to portions of tubing exposed to direct sunlight.

1.8 WARRANTY

.1 A limited warranty of up to 25 years for its Non-Oxygen Barrier PEX tubing.

2 Products

2.1 MANUFACTURERS

.1 Heat Link Group Inc.

.2 Approved equal.

2.2 COMPONENTS

.1 PEX-a Tubing 13mm (½ inch) to 38mm (1½ in) nominal size:

.1 Material: Crosslinked polyethylene (PEX) manufactured by PEX-a or Engel method.

.2 Type: Heat Link® – Heat Link® PEX-a with oxygen barrier that meets DIN 4726.

.3 In compliance with ASTM F876, ASTM F877, CAN/CSA B137.5, NSF/ANSI-14, AWWA C904 and tested for compliance by an independent third-party agency.

.4 Standard grade hydrostatic design and pressure ratings from PPI TR-4.

.5 Fire-rated assembly listings in accordance with CAN/ULC S101 and ANSI/UL 263 through certification listings with Underwriters Laboratories (UL) and Underwriters Laboratories of Canada (cUL), and Warnock Hersey (WH) – See INFO 33 (L2333) and 34 (L2334) for more details.

.2 Pre-Sleeved Piping 13mm ((½ inch) to 19mm (¾ inch) nominal size:

.1 Material:

.1 High Density Polyethylene (HDPE) corrugated sleeve with PEX-a carrier tubing.

.3 Stainless Steel Press Sleeve

.1 Material: 304 Annealed Stainless Steel.

.2 Type: Heat Link® Stainless Steel Press Sleeve.

.3 In compliance with ASTM F877, CAN/CSA B137.5, NSF/ANSI-14, NSF/ANSI-61, NSF/ANSI-372, and tested for compliance by an independent third-party agency.

.4 PEX Press Fittings: elbows, couplings, plugs, tees, adapters 13mm (½ inch) to 51mm (2 in) nominal size:

.1 Material

.1 Modified Polyphenylsulfone.

.2 Polyphenylsulfone.

.3 UNS No. C69300 Eco Brass.

.2 Type:

.1 Heat Link® HPP fittings.

.2 Heat Link® No Lead Brass fittings.

.3 In compliance with ASTM F2159 or ASTM F1807, ASTM F877, CAN/CSA B137.5, NSF/ANSI-14, NSF/ANSI-61, NSF/ANSI-372, and tested for compliance by an independent third-party agency.

.4 PEX tubing connection to each ASTM F2159 or ASTM F1807 outlet by corresponding stainless steel press sleeve.

.5 Press tools to install the Stainless-Steel Press Sleeves are supplied by the PEX tubing manufacturer.

.6 All buried fittings will be installed and sealed in accordance with the manufacturer's instructions.

.5 PEX Expansion Ring

.1 Material: Crosslinked polyethylene (PEX) manufactured by PEX-a or Engel method.

.2 Type: Heat Link® PEX Expansion Ring.

.3 In compliance with ASTM F877, ASTM F1960, CAN/CSA B137.5, and tested for compliance by an independent third-party agency.

.6 PEX Expansion Fittings: elbows, couplings, plugs, tees, adapters 13mm ((½ inch) to 25mm (1 in) nominal size

.1 Material

.1 Modified Polyphenylsulfone.

.2 Polyphenylsulfone.

.3 UNS No. C69300 Eco Brass.

.2 Type:

.1 Heat Link® PEX F1960 HPP fittings.

.2 Heat Link® PEX F1960 No Lead Brass fittings.

.3 In compliance with ASTM F1960, ASTM F877, CAN/CSA B137.5, NSF/ANSI-14, NSF/ANSI-61, NSF/ANSI-372, and tested for compliance by an independent third-party agency.

.4 PEX tubing connection to each ASTM F1960 outlet by corresponding PEX expansion ring.

.5 All buried fittings will be installed and sealed in accordance with the manufacturer's instructions.

.7 PEX-a Compression Fittings: 13mm (½ inch) to 16mm (⅝ inch) nominal size:

.1 Material:

.1 Brass.

.2 In compliance with ASTM F877, CAN/CSA B137.5.

.3 Fittings will consist of a compression nut, split ring ferrule, and a fitting body insert.

.4 All buried fittings will be installed and sealed in accordance with the manufacturer's instructions.

.8 Stainless Steel Manifolds with Flow Meters:

.1 Stainless Steel manifold assemblies shall be constructed of stainless-steel with 32mm (1-1/4 inch) trunk, sized for flow rates required on manifold schedule.

.2 Manifold assemblies shall be furnished and installed with:

.1 Supply and return ball valves.

.2 Loop balancing and isolation valves.

.3 Supply and return drain connections.

.4 Mounting brackets.

.5 Manual balancing valves with visual flow meters 5 L/min (1.5 gpm).

.6 Manifolds support 13mm (½ inch), 16mm (5 L/min ⅝ inch), and 19mm (¾ inch) PEX tubing.

.7 Use appropriately sized manifold housings to allow the manifold assemblies to be mounted inside the wall cavity.

.9 Accessories:

.1 Bend supports designed for maintaining tight radius bends are supplied by the PEX tubing manufacturer.

.2 Conduit elbows designed to direct and protect PEX tubing in transition area where tubing enters and exits a concrete slab are supplied by the PEX tubing manufacturer.

.3 Press tools to install the Stainless-Steel Press Sleeves are supplied by the PEX tubing manufacturer.

.4 All horizontal tubing hangers and riser clamps are epoxy-coated material.

.5 Tie Straps used to secure PEX tubing to wire mesh or rebar are supplied by the PEX tubing manufacturer. Minimum 140mm (5-½ inches) nylon cable tie. Minimum 9kg (20 lbs.) tensile strength.

.6 Polypropylene staples used to secure 13mm (½ inch) to 16mm (⅝ inch) PEX tubing directly onto polystyrene insulation are supplied by the PEX tubing manufacturer. Ensure that the proper size staples are used for the insulation thickness. Use 38mm (1-½ inch) staples for 25mm (1 inch) polystyrene insulation and 51mm (2 inch) staples for 38mm (1-½ inch) or thicker polystyrene insulation.

.7 Tubing tracking used to hold 13mm (½ inch) to 16mm (⅝ inch) PEX tubing are supplied by the PEX tubing manufacturer. Spacing as indicated on approved shop drawings. Can be fastened to concrete, steel Q decking, and polystyrene insulation.

.8 Recessed manifold housings are supplied by the PEX tubing manufacturer. Minimum 16 gauge (1.2 mm) galvanized steel construction with paintable satin coated steel cover. Manifold housings shall be sized to accommodate the manifolds and associated equipment.

.9 Surface mount manifold housings are supplied by the PEX tubing manufacturer. Minimum 16 gauge (1.2 mm) galvanized steel and paintable satin coated steel construction. Manifold housings shall be sized to accommodate the manifolds and associated equipment.

.10 Controls:

.1 Refer to Section 23 09 00 - Instrumentation and Control for HVAC and plans for radiant system controls.

3 Execution

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify that site conditions are acceptable for installation of the hydronic system.

.2 Do not proceed with installation of the hydronic system until unacceptable conditions are corrected.

3.2 INSTALLATION

.1 Install hydronic radiant system according to approved shop drawings or system layouts.

.2 Comply with manufacturer's product data, including product technical bulletins, installation instructions, design drawings, including the following.

.3 PEX-a tubing installation:

.1 Install tubing in compliance with manufacturer’s Installation Guide (L3390).

.4 All loop numbers to be clearly marked on PEX tubing wall before being connected to manifold. Verify each loop length. All loops to be identified to allow for system balancing in the future.

.5 Through-penetration Firestop:

.1 Ensure compliance of one- and two-hour rated through penetration assemblies in accordance with CAN/ULC S115-05 and ASTM E814.

.2 A list of firestop manufacturers that list PEX tubing with their firestop systems is available from the PEX tubing manufacturer.

.6 Related Products Installation:

.1 Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Pressure test the PEX-a tubing before and during burial, as per manufacturer’s instructions.

.2 Manufacturer’s Field Services: Provide manufacturer’s field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer’s instructions.

3.4 ADJUSTING

.1 Balance all manifold loops according to the flow rates specified on the manifold schedule.

3.5 CLEANING

.1 Remove temporary coverings and protection of adjacent work areas.

.2 Repair or replace damaged installed products.

.3 Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

.4 Remove construction debris from project site and legally dispose of debris.

3.6 PROTECTION

.1 Protect installed work from damage due to subsequent construction activity on the site.

.2 In all areas where other trades will be drilling, coring or anchoring other equipment, furniture, or structures to the slab, locations of in-slab tubing shall be marked on the concrete slab surface to avoid penetration of fasteners used.

.3 Manifolds to be wrapped with plastic sheets for protection from dirt/dust, construction chemicals, and/or concrete in the course of construction.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for start-up, verification, and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems.

.2 Check out demonstration or proper operation of components.

.3 On-site operational tests.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least [99] % during test period.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Consultant that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01330 - Submittal Procedures.

.2 Final Report: submit report to consultant.

.1 Include measurements, final settings, and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by consultant before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments, and modifications to EMCS as set during commissioning and submit to consultant in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions, or energy consumption.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of consultant before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals.

1.6 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

.2 Carry out commissioning under direction of consultant and in presence of consultant representative.

.3 Inform, and obtain approval from, Consultant in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of consultant until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software.

.7 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by consultant.

1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Manager.

.3 Commission integrated systems using procedures prescribed by Commissioning Manager.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

.1 General: consists of field tests of equipment just prior to installation.

.2 Testing may be on site or at Contractor's premises as approved by consultant representative,

.3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.

.4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

.5 Additional instruments to include:

.1 DP transmitters.

.2 DP switches used for dirty filter indication and fan status.

.6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp metre at source.

.7 After setting, test zero and span in 10% increments through entire range while both increasing and decreasing pressure.

.8 Consultant representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".

.9 Transmitters above 0.5% error will be rejected.

.10 DP switches to open and close within 2% of setpoint.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits, and engineering units. Include space on commissioning technician and Consultant representative. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of consultant representative and provide:

.1 2 technical personnel capable of re-calibrating field hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Consultant's representative acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final startup testing.

.5 O& M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Consultant representative.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.

.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 Prior to beginning of 30-day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

.2 Test to last at least 30 consecutive 24-hour days.

.3 Tests to include:

.4 System will be accepted when:

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Consultant representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by consultant representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Consultant representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks, and lockouts in accordance with Section 01 79 00 - Demonstration and Training.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for training program, instructors, and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 DEFINITIONS

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to consultant representative 30 days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one week after completion of training program that training has been satisfactorily completed.

1.4 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Consultant reserves right to approve instructors.

1.5 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance, and pertinent safety requirements of EMCS installed.

.2 Training to be project specific.

1.6 TIME FOR TRAINING

.1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15-minute breaks and excluding lunch time).

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.8 TRAINING PROGRAM

.1 To be in 2 phases over a 3month period.

.2 Phase 1: 2-day program to begin before 30-day test period at time mutually agreeable to Contractor, Consultant and Commissioning Manager.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during 30-day test period.

.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.

.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.3 Phase 2: 2-day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.

.1 Provide multiple instructors on pre-arranged schedule. Include at least following:

.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

.2 Equipment maintenance training: provide personnel with 2 days training within 5-day period in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.

.3 Programmers: provide personnel with 2 days training within 5-day period in following subjects in approximate percentages of total course shown:

Software and architecture: 10%
Application programs: 15%
Controller programming: 50%
Trouble shooting and debugging10%
Colour graphic generation: 15%

1.9 ADDITIONAL TRAINING

.1 List courses offered by name, duration, and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.10 MONITORING OF TRAINING

.1 Client representative to monitor training program and may modify schedule and content.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1-2004, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

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

.1 ASHRAE STD 135-2016, BACNET - Data Communication Protocol for Building Automation and Control Network.

.3 CSA Group (CSA).

.1 CAN/CSA-Z234.1-00(R2011), Canadian Metric Practice Guide.

.4 ISO/IEC Telecommunications and Information Exchange Between Systems

.1 ISO/IEC 14908-1:2012 Control Network Protocol Specification.

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA), 2012,

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.6 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Grey Colour for Indoor Switch Gear.

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

.1 Safety Data Sheets (SDS).

.8 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ABBREVIATIONS AND ACRONYMS

.1 Acronyms used in EMCS:

.1 AEL - Average Effectiveness Level

.2 AI - Analog Input

.3 AIT - Agreement on International Trade

.4 AO - Analog Output

.5 BACnet - Building Automation and Control Network.

.6 BC(s) - Building Controller(s).

.7 BECC - Building Environmental Control Centre.

.8 CAD - Computer Aided Design.

.9 CDL - Control Description Logic.

.10 CDS - Control Design Schematic.

.11 COSV - Change of State or Value.

.12 CPU - Central Processing Unit.

.13 DI - Digital Input.

.14 DO - Digital Output.

.15 DP - Differential Pressure.

.16 ECU - Equipment Control Unit.

.17 EMCS - Energy Monitoring and Control System.

.18 HVAC - Heating, Ventilation, Air Conditioning.

.19 IDE - Interface Device Equipment.

.20 I/O - Input/Output.

.21 ISA - Industry Standard Architecture.

.22 LAN - Local Area Network.

.23 LCU - Local Control Unit.

.24 MCU - Master Control Unit.

.25 NAFTA - North American Free Trade Agreement.

.26 NC - Normally Closed.

.27 NO - Normally Open.

.28 OS - Operating System.

.29 O&M - Operation and Maintenance.

.30 OWS - Operator Workstation.

.31 PC - Personal Computer.

.32 PCI - Peripheral Control Interface.

.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.

.34 PID - Proportional, Integral and Derivative.

.35 RAM - Random Access Memory.

.36 SP - Static Pressure.

.37 ROM - Read Only Memory.

.38 TCU - Terminal Control Unit.

.39 USB - Universal Serial Bus.

.40 UPS - Uninterruptible Power Supply.

.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier, and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide [25] character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25-character field for each point identifier.

.2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32-character field for each point expansion.

.3 Point Object Type: points fall into following object types:

.1 AI (analog input).

.2 AO (analog output).

.3 DI (digital input).

.4 DO (digital output).

.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.

.2 Refer also to Section 25 05 54 - EMCS: Identification.

1.5 SYSTEM DESCRIPTION

.1 Refer to mechanical drawings for system control sequence.

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Control devices as listed in I/O point summary tables.

.3 OWS(s).

.4 Data communications equipment necessary to effect EMCS data transmission system.

.5 Field control devices.

.6 Software/Hardware complete with full documentation.

.7 Complete operating and maintenance manuals.

.8 Training of personnel.

.9 Acceptance tests, technical support during commissioning, full documentation.

.10 Wiring interface co-ordination of equipment supplied by others.

.11 Miscellaneous work as specified in these sections and as indicated.

.3 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by the client representative and Consultant representative prior to installation.

.3 Location of controllers as reviewed by the client representative and consultant representative prior to installation.

.4 Provide utility power to EMCS and emergency power to EMCS as indicated.

.5 Metric references: in accordance with CAN/CSA Z234.1.

.4 Language Operating Requirements:

.1 Provide English operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.

.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high-level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.1 Input and output commands and messages from operator-initiated functions, field related changes, and alarms as defined in CDL's or assigned limits (i.e., commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-defilements).

.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS and to be able to operate one terminal in English, Point name expansions in English.

.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.

.3 Submit for review:

.1 Equipment list and systems manufacturers at time of tender within 10 days after award of contract.

.2 List existing field control devices to be re-used included in tender, along with unit price.

.4 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Consultant representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Submit certificate of acceptance from authority having jurisdiction to consultant representative.

.8 Existing devices intended for re-use: submit test report.

1.7 QUALITY ASSURANCE

.1 Have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance, and emergency service on systems,

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7-year guarantee of availability of spare parts after obsolescence.

.4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

.5 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: the client representative and consultant representative with schedule within 2 weeks after award of Contract.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling.

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

.3 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.

.4 Separate for reuse and recycling and place in designated containers.

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

.6 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

.7 Label location of salvaged material's storage areas and provide barriers and security devices.

.8 Ensure emptied containers are sealed and stored safely.

.9 Divert unused metal materials from landfill to metal recycling facility.

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

1.9 EXISTING- CONTROL COMPONENTS

.1 Utilize existing control wiring and piping as indicated.

.2 Re-use field control devices that are usable in their original configuration

.1 Do not modify original design of existing devices without written permission from consultant representative.

.2 Provide for new, properly designed device where re-usability of components is uncertain.

.3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.

.1 Furnish test report within 30 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by consultant representative.

.2 Failure to produce test report will constitute acceptance of existing devices by contractor.

.4 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from consultant representative.

.1 Be responsible for repair costs due to negligence or abuse of equipment.

.2 Responsibility for existing devices terminates upon final acceptance of EMCS applicable portions of EMCS as approved by Consultant Representative.

.7 Remove existing controls not re-used or not required. Place in approved storage. for disposition as directed.

2 Products

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to CEA 709.1,ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: in accordance with Section 09 91 23 - Interior Painting, supplemented as follows:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.

.3 Clean and prime exposed hangers, racks, fastenings, and other support components.

.4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

.2 Section Includes.

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.3 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.

.1 Location of local office.

.2 Description and location of installing and servicing technical staff.

.3 Location and qualifications of programming design and programming support staff.

.4 List of spare parts.

.5 Location of spare parts stock.

.6 Names of sub-contractors and site-specific key personnel.

.7 Sketch of site-specific system architecture.

.8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.

.9 Descriptive brochures.

.10 Sample CDL and graphics (systems schematics).

.11 Response time for each type of command and report.

.12 Item-by-item statement of compliance.

.13 Proof of demonstrated ability of system to communicate utilizing BACnet.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.

.2 Submit preliminary design document within 5 working days after contract award, for review by consultant representative.

.3 Shop Drawings, design documents, product data and software to be PDF format.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

.5 Soft copy to be in Microsoft Word latest version format, structured using menu format for easy loading and retrieval on OWS.

1.5 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:

.1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.2 Detailed system architecture showing all points associated with each controller including signal levels, pressures where new EMCS ties into existing control equipment.

.3 Spare point capacity of each controller by number and type.

.4 Controller locations.

.5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

.7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).

.8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

.9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model, and range of velocity transmitter.

1.6 DETAILED SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:

.1 Corrected and updated versions (PDFs) of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.

.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each point including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules, and terminations.

.4 Complete Point Name Lists.

.5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.

.6 Software and programming details associated with each point.

.7 Manufacturer's recommended installation instructions and procedures.

.8 Input and output signal levels or pressures where new system ties into existing control equipment.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.

.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.9 Listing and example of specified reports.

.10 Listing of time-of-day schedules.

.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator workspace.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

.15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.7 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between Contract Document requirements and actual items (e.g.: points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Consultant retains right to revise sequence or subsequent CDL prior to software finalization without cost to consultant.

2 Products

3 Execution

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for final control diagrams and operation and maintenance (O& M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Workstation.

.3 For additional acronyms and definitions refer to Section 25 05 01- EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 78 00- Closeout Procedures, supplemented and modified by requirements of this Section.

.2 Submit As-built drawings, Operation and Maintenance Manual, Record Documents to Consultant n English.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.4 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02- EMCS: Submittals and Review Process and include:

.1 Changes to Contract Documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11- EMCS: Start-up, Verification and Commissioning.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Consultant Representative.

.3 Provide before acceptance 3 Hard and 1 soft copy incorporating changes made during final review.

1.5 O& M MANUALS

.1 Custom design O& Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide 2complete sets of hard and soft copies prior to system or equipment tests

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics, or in-depth control theory.

.4 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces, and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented for implementation in automatic mode.

.5 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input, and output formats.

.3 Emergency, alarm, and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including keystrokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device.

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair, or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller, and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing, and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor, or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit, and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-21, The Canadian Electrical Code, Part I (25th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01- EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00- Submittal Procedures supplemented and modified by requirements of this Section.

.2 Submit to Consultant Representative for approval samples of nameplates, identification tags and list of proposed wording.

2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3mm thick Melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67mm minimum.

.3 Lettering: minimum 7mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5mm high produced from laser printer in black.

.4 Data to include point name and point address.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Consultant Representative.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange-coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Consultant's representative.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets, and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 PNEUMATIC TUBING

.1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

2.7 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with consultant representative during "Preliminary Design Review".

3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are always visible and legible.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI/ASME B16.22-2021, Wrought Copper and Copper Alloy Solder Joint Pressures Fittings.

.2 ANSI C2-2012, National Electrical Safety Code.

.3 ANSI/NFPA 70-2020, National Electrical Code.

.2 CSA Group

.1 CSA C22.1:21 Canadian Electrical Code, Part (25th Edition), Safety Standard for Electrical Installations

.2 CAN/CSA-C22.3 No. 7-20, Underground Systems.

.3 CSA C22.2 No. 45.1:22 Electrical Rigid Metal Conduit.

.4 CSA C22.2 No. 56-17(R2022), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.5 CSA C22.2 No. 83-M85(R2022), Electrical Metallic Tubing.

.6 CAN/CSA-C22.3 No. 1-20, Overhead Systems.

1.2 SYSTEM DESCRIPTION

.1 Electrical:

.1 Provide power wiring from emergency power panels to EMCS field panels. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.

.2 Hard wiring between field control devices and EMCS field panels.

.3 Communication wiring between EMCS field panels and OWS's including main control centre BECC.

.4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.2 Mechanical:

.1 Pipe Taps Required for EMCS equipment will be supplied and installed by EMCS Contractor.

.2 Wells and Control Valves Shall Be Supplied by EMCS Contractor and Installed by Division 23.

.3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Division 23. Costs to be carried by designated trade.

.3 Structural:

.1 Special steelwork as required for installation of work.

1.3 PERSONNEL QUALIFICATIONS

.1 Qualified supervisory personnel to:

.1 Continuously direct and monitor all work.

.2 Attend site meetings.

1.4 EXISTING CONDITIONS

.1 Cutting and Patching: refer to Section 01 73 00- Execution supplemented as specified herein.

.2 Repair all surfaces damaged during execution of work.

.3 Turn over to the client maintenance group existing materials removed from work not identified for re-use.

2 Products

2.1 PIPING

.1 DHW, DCW, Sanitary, storm water: refer to Section 22 05 00

.2 Hot water heating, chilled water, Condenser water, Refrigeration: refer to Section 23.05 15

.3 Insulation: refer to Section 23 07 19.

.4 Hangers and supports refer to Section 23 05 29

2.2 SPECIAL SUPPORTS

.1 Structural grade steel, primed and painted after construction and before installation.

2.3 WIRING

.1 As per requirements of Division 26.

.2 For 70V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.

.3 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.

.4 Sizes:

.1 120V Power supply: to match or exceed breaker, size #12 minimum.

.2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.

.3 Field wiring to digital device: #18 AWG

.4 Analog input and output: shielded 18 minimum solid copper. Wiring must be continuous without joints.

.5 More than 4 conductors: #22 minimum solid copper.

.5 Terminations:

.1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.4 CONDUIT

.1 As per requirements of Division 26.

.2 Electrical metallic tubing to CSA C22.2 No. 83. Flexible and liquid tight flexible metal conduit to CSA C22.2 No. 56. Rigid steel threaded conduit to CSA C22.2 No. 45.1.

.3 Junction and pull boxes: welded steel.

.1 Surface mounting cast FS: screw-on flat covers.

.2 Flush mounting: covers with 25 mm minimum extension all round.

.4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.

.5 Outlet boxes: 100 mm minimum, square.

.6 Conduit boxes, fittings:

.1 Bushings and connectors: with nylon insulated throats.

.2 With push pennies to prevent entry of foreign materials.

.7 Fittings for rigid conduit:

.1 Couplings and fittings: threaded type steel.

.2 Double locknuts and insulated bushings: use on sheet metal boxes.

.3 Use factory "ells" where 90-degree bends required for 25 mm and larger conduits.

.8 Fittings for thin wall conduit:

.1 Connectors and couplings: steel, set screw type.

2.5 WIRING DEVICES, COVER PLATES

.1 Conform to CSA.

.2 Receptacles:

.1 Duplex: CSA type 5-15R.

.2 Single: CSA type 5-15R.

.3 Cover plates and blank plates: finish to match other plates in area.

2.6 STARTERS, CONTROL DEVICES

.1 Across-the-line magnetic starters:

.1 Enclosures: CSA Type 1, except where otherwise specified.

.2 Size, type, and rating: to suit motors.

.2 Starter diagrams:

.1 Provide copy of wiring and schematic diagrams - mount one copy in each starter with additional copies for operation and maintenance manual.

.3 Auxiliary Control Devices:

.1 Control transformers: 60 Hz, primary voltage to suit supply, 120 V single phase secondary, VA rating to suit load plus 20% margin.

.2 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.

.3 Hand-Off-Automatic switch: heavy duty type, knob lever operator.

.4 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.

.4 Finish for starters:

.1 Exterior: in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Interior: white.

2.7 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

.1 Solid masonry, tile, and plastic surfaces: lead anchors or nylon shields.

.1 Hollow masonry walls suspended drywall ceilings: toggle bolts.

.2 Exposed conduits or cables:

.1 50 mm diameter and smaller: one-hole steel straps.

.2 Larger than 50 mm diameter: two-hole steel straps.

.3 Suspended support systems:

.1 Individual cable or conduit runs support with 6 mm diameter threaded rods and support clips.

.2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturers and CSA labels are visible and legible after commissioning is complete.

3.2 PIPING

.1 DHW, DCW, Sanitary, storm water: refer to Section 22 05 00

.2 Hot water heating, chilled water, Condenser water, Refrigeration: refer to Section 23.05 15

.3 Insulation: refer to Section 23 07 19.

3.3 MECHANICAL PIPING

.1 Install piping straight, parallel, and close to building structure with required grades for drainage and venting.

.2 Ream ends of pipes before assembly.

.3 Copper tubing not to come into contact with dissimilar metal, use dielectric union to connect.

.4 Use non-corrosive lubricant or Teflon tape on male screwed threads.

.5 Clean ends of pipes, tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.

.6 Install di-electric couplings where dissimilar metals joined.

.7 Sleeves:

.1 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.

.2 Caulking:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere: provide space for fire stopping by Section 07 84 00– Fire Stopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

.8 Pressure tests:

.1 Pressure tests all piping systems modified under this contract to 1 1/2 times maximum working pressure or 860 kPa (whichever is greater) for 4 hours without loss of pressure. Test all piping systems modified under this contract by means of visual inspection of each connection.

.2 Isolate equipment, components, not designed to withstand test pressure.

.9 Introduce system pressure carefully into new piping.

3.4 SUPPORTS

.1 Install special supports as required and as indicated.

3.5 ELECTRICAL GENERAL

.1 Do complete installation in accordance with requirements of:

.1 Division 26, this specification.

.2 CSA 22.1 Canadian Electrical Code.

.3 ANSI/NFPA 70.

.4 ANSI C2.

.2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.

.3 Do underground installation to CAN/CSA-C22.3 No.7, except where otherwise specified.

.4 Conform to manufacturer's recommendations for storage, handling and installation.

.5 Check factory connections and joints. Tighten where necessary to ensure continuity.

.6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.

.8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.

.9 Install conduits, and sleeves prior to pouring of concrete.

.10 Holes through exterior wall and roofs: flash and make weatherproof.

.11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.

.12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.6 CONDUIT SYSTEM

.1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduits fill not to exceed 40%. Design drawings do not show conduit layout.

.2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.

.3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Consultant Representative before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.

.4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.

.5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.

.6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.

.7 Limit conduit length between pull boxes to less than 30 m.

.8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.

.9 Fastenings and supports for conduits, cables, and equipment:

.1 Provide metal brackets, frames, hangers, clamps, and related types of support structures as indicated and as required to support cable and conduit runs.

.2 Provide adequate support for raceways and cables, sloped vertically to equipment.

.3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Consultant Representative.

.10 Install polypropylene fish cord in empty conduits for future use.

.11 Where conduits become blocked, remove, and replace blocked sections.

.12 Pass conduits through structural members only after receipt of Consultant's Representative's written approval.

.13 Conduits may be run in flanged portion of structural steel.

.14 Group conduits wherever possible on suspended or surface channels.

.15 Pull boxes:

.1 Install in inconspicuous but accessible locations.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper or foam to prevent entry of construction material.

.4 Provide correct size of openings. Reducing washers not permitted.

.5 Mark location of pull boxes on record drawings.

.6 Identify AC power junction boxes, by panel and circuit breaker.

.16 Install terminal blocks or strips indicated in cabinets.

.17 Install bonding conductor for 120 volt and above in conduit.

3.7 WIRING

.1 Install multiple wiring in ducts simultaneously.

.2 Do not pull spliced wiring inside conduits or ducts.

.3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.

.4 Tests: use only qualified personnel. Demonstrate that:

.1 Circuits are continuous, free from shorts, unspecified grounds.

.2 Resistance to ground of all circuits is greater than 50 Megohms.

.5 Provide Consultant representative with test results showing locations, circuits, results of tests.

.6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

.7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly, and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

.8 Do not allow wiring to come into direct physical contact with compression screw.

.9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.8 WIRING DEVICES, COVER PLATES

.1 Receptacles:

.1 Install vertically in gang type outlet box when more than one receptacle is required in one location.

.2 Cover plates:

.1 Install suitable common cover plate where wiring devices are grouped.

.2 Use flush type cover plates only on flush type outlet boxes.

3.9 STARTERS, CONTROL DEVICES

.1 Install and make power and control connections as indicated.

.2 Install correct over-current devices.

.3 Identify each wire, terminal for external connections with permanent number marking identical to diagram.

.4 Performance Verification:

.1 Operate switches and controls to verify functioning.

.2 Perform start and stop sequences of contactors and relays.

.3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.10 GROUNDING

.1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors, and accessories.

.2 Install separate grounding conductors in conduit within building.

.3 Install ground wire in all PVC ducts and in tunnel conduit systems.

.4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.11 TESTS

.1 General:

.1 Perform following tests in addition to tests specified Section 25 08 20- EMCS: Warranty and Maintenance.

.2 Give 14 days written notice of intention to test.

.3 Conduct in presence of Consultant Representative and authority having jurisdiction.

.4 Conceal work only after tests satisfactorily completed.

.5 Report results of tests to Consultant Representative in writing.

.6 Preliminary tests:

.1 Conduct as directed to verify compliance with specified requirements.

.2 Make needed changes, adjustments, replacements.

.3 Insulation resistance tests:

.1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.

.2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Consultant Representative and authority having jurisdiction.

3.12 IDENTIFICATION

.1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

.2 References.

.1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.

.2 Canadian Standards Association (CSA International).

.1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings.

1.2 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 OWS - Operator Workstation.

.3 For additional acronyms and definitions refer to Section 25 05 01- EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Submit detailed preventative maintenance schedule for system components to consultant representative.

.3 Submit detailed inspection reports consultant representative.

.4 Submit dated, maintenance task lists to consultant representative and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.

.2 Device type and range.

.3 Measured value.

.4 System displayed value.

.5 Calibration detail

.6 Indication if adjustment required,

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00- Closeout Submittals.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Consultant Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Consultant Representative in accordance with Section 01 78 00-Closeout Submittals “As-built drawings" documentation and commissioning reports to reflect changes, adjustments, and modifications to EMCS made during warranty period.

1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:

.1 Initiate service calls when EMCS is not functioning correctly.

.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.3 Furnish telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS within 2 hours after receiving request for service.

.5 Perform Work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date, and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.5 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Consultant Representative.

1.5 SERVICE CONTRACTS

.1 Provide in-depth technical expertise and assistance to Consultant Representative and Commissioning Manager in preparation and implementation of service contracts and in-house preventive maintenance procedures.

.2 Service Contracts to include:

.1 Annual verification of field points for operation and calibration.

.2 Complete inventory of installed system.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to the city of Yellowknife maintenance group as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

.1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.

.2 Calibrate each field input/output device in accordance with Canada Labour Code - Part I and CSA Z204.

.3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

.1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.

.2 Check equipment cooling fans as required.

.3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.

.4 Review system performance with the client maintenance group to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

.1 Minor inspection.

.2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.3 Check signal, voltage and system isolation of BC(s), peripherals, interface, and other panels.

.4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.

.5 Provide mechanical adjustments, and necessary maintenance on printers.

.6 Run system software diagnostics as required.

.7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

.1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for building automation controllers including:

.1 Master Control Unit (MCU).

.2 Local Control Unit (LCU).

.3 Equipment Control Unit (ECU).

.4 Terminal Control Unit (TCU).

1.2 REFERENCE STANDARDS

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

.1 ASHRAE 2023, Applications Handbook, SI Edition.

.2 CSA Group (CSA).

.1 C22.2 No.205:17(2022), Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE).

.1 IEEE C37.90.1-2012 Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

.4 Public Works and Government Services Canada (PWGSC)/Real Property Branch/Architectural and Engineering Services.

.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 DESCRIPTION

.1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controller quantity and point contents to be approved by Consultant Representative at time of preliminary design review.

.2 Controllers: stand-alone intelligent Control Units.

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for resetting such as outdoor air temperature may be located in other Controller(s).

.1 Secondary input used for resetting such as outdoor air temperature may be located in other Controller(s).

.3 Interface to include provisions for use of dial-up modem for interconnection with remote modem.

.1 Dial-up communications to use 56 Kbit modems and voice grade telephone lines.

.2 Each stand-alone panel may have its own modem or group of stand-alone panels may share modem.

1.5 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 25 % of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring (if remote units).

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.4 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.

.5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by consultant representative for ceiling mounting.

.6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.7 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section01 33 00 - Submittal Procedures and Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

1.7 MAINTENANCE

.1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03 - EMCS: Project Record Documents.

2 Products

2.1 MASTER CONTROL UNIT (MCU)

.1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.

.2 Include high speed communication LAN Port for Peer-to-Peer communications with OWS(s) and other MCU level devices.

.1 MCU must support BACnet.

.3 MCU local I/O capacity as follows:

.1 MCU I/O points as allocated in I/O Summary Table referenced in MD13800.

.2 LCUs may be added to support system functions.

.4 Central Processing Unit (CPU).

.1 Processor to consist of minimum 16-bit microprocessor capable of supporting software to meet specified requirements.

.2 CPU idle time to be more than 30 % when system configured to maximum input and output with worst case program use.

.3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72-hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.

.5 Local Operator Terminal (OT): Provide OT for each MCU unless otherwise specified in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

.1 Mount access/display panel in MCU or in suitable enclosure beside MCU as approved by Consultant Representative.

.2 Support operator's terminal for local command entry, instantaneous and historical data display, programs, additions, and modifications.

.3 Display simultaneously minimum of 16 point identifiers to allow operator to view single screen dynamic displays depicting entire mechanical systems. Point identifiers to be in English.

.4 Functions to include, but not be limited to, following:

.1 Start and stop points.

.2 Modify setpoints.

.3 Modify PID loop parameters.

.4 Override PID control.

.5 Change time/date.

.6 Add/modify/start/stop weekly scheduling.

.7 Add/modify setpoint weekly scheduling.

.8 Enter temporary override schedules.

.9 Define holiday schedules.

.10 View analog limits.

.11 Enter/modify analog warning limits.

.12 Enter/modify analog alarm limits.

.13 Enter/modify analog differentials.

.5 Provide access to real and calculated points in controller to which it is connected or to another controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and other controller in network.

.6 Operator access to OTs: same as OWS user password and password changes to automatically be downloaded to controllers on network.

.7 Provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.

.8 Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

2.2 LOCAL CONTROL UNIT (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points integral to one Building System to be resident on only one controller.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:

.1 Include minimum 2 interface ports for connection of local computer terminal.

.2 Design so that shorts, opens, or grounds on input or output will not interfere with other input or output signals.

.3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.

.4 Include power supplies for operation of LCU and associated field equipment.

.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

.6 Provide conveniently located screw type or spade lug terminals for field wiring.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

.1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

.3 VAV Terminal Controller.

.1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.

.2 Controller to support point definition; in accordance with Section [25 05 01 - EMCS: General Requirements].

.3 Controller to operate independent of network in case of communication failure.

.4 Controller to include damper actuator and terminations for input and output sensors and devices.

2.4 SOFTWARE

.1 General.

.1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

.2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.

.3 Include initial programming of Controllers, for entire system.

.2 Program and data storage.

.1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.

.2 Maintain CDL and operating data including setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages.

.1 Program Control Description Logic software (CDL) using English like or graphical, high level, general control language.

.2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed unless approved by Consultant Representative.

.4 Operator Terminal interface.

.1 Operating and control functions include:

.1 Multi-level password access protection to allow user/manager to limit workstation control.

.2 Alarm management: processing and messages.

.3 Operator commands.

.4 Reports.

.5 Displays.

.6 Point identification.

.5 Pseudo or calculated points.

.1 Software to provide access to value or status in controller or other networked controller in order to define and calculate pseudo point. When current pseudo point value is derived, normal alarm checks must be performed, or value used to totalize.

.2 Inputs and outputs for process: include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to number of other processes (e.g., cascading).

.6 Control Description Logic (CDL):

.1 Capable of generating on-line project specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.

.2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g., setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.

.3 Perform changes to CDL on-line.

.4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Energy optimization routines including enthalpy control, supply temperature reset, to be LCU or MCU resident functions and form part of CDL.

.6 MCU to be able to perform following pre-tested control algorithms:

.1 Two position control.

.2 Proportional Integral and Derivative (PID) control.

.7 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.

.8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.9 Power Fail Restart: upon detection of power failure system to verify availability of Emergency Power as determined by emergency power transfer switches and analyse controlled equipment to determine its appropriate status under Emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyse status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.7 Event and Alarm management: use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will ensure that only principal alarms are reported to OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition.

.8 Energy management programs: include specific summarizing reports, with date stamp indicating sensor details which activated and or terminated feature.

.1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:

.1 Time of day scheduling.

.2 Calendar based scheduling.

.3 Holiday scheduling.

.4 Temporary schedule overrides.

.5 Optimal start stop.

.6 Night setback control.

.7 Enthalpy (economizer) switchover.

.8 Peak demand limiting.

.9 Temperature compensated load rolling.

.10 Fan speed/flow rate control.

.11 Cold deck reset.

.12 Hot deck reset.

.13 Hot water reset.

.14 Chilled water reset.

.15 Condenser water reset.

.16 Night purge.

.2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.

.3 Apply programs to equipment and systems as specified or requested by the Consultant Representative.

.9 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 MCUs to accumulate and automatically store run-time for binary input and output points.

.2 MCU to automatically sample, calculate and store consumption totals on daily, weekly, or monthly basis for user-selected analog or binary pulse input-type points.

.3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly, or monthly basis.

.4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.

.5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (e.g. kWH, litres, tonnes, etc.).

.6 Store event totalization records with minimum of 9,999,999 events before reset.

.7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 POINT NAME SUPPORT

.1 Controllers (MCU, LCU) to support PWGSC point naming convention as defined in Section 25 05 01 - EMCS: General Requirements.

3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Consultant Representative.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures as indicated.

.2 Provide necessary power from local 120V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors, controls, meters, switches, transducers, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

.2 Related Sections:

.1 Section 01 73 00 - Execution.

.2 Section 07 84 00 - Fire stopping.

.3 Section 23 33 15 - Dampers - Operating.

.4 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.

.5 Section 25 05 01 - EMCS: General Requirements.

.6 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.7 Section 25 05 54 - EMCS: Identification.

.8 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

.9 Section 26 05 00 - Common Work Results for Electrical.

.10 Section 26 27 26 - Wiring Devices.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-2022, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-2-2005, Standard Conformance Test for Instrument Transformers.

.2 ASTM International (ASTM)

.1 ASTM B148-97(2009), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250--2021 Enclosure Types

.4 Air Movement and Control Association, Inc. (AMCA).

.1 AMCA Standard 500-D-18, Laboratory Method of Testing Dampers for Rating.

.5 CSA Group CSA Group

.1 CSA-C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

.2 Pre-Installation Tests.

.1 Submit samples at random from equipment shipped, as requested by Consultant Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 00 - Execution Requirements supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

.3 Turn over to the client group existing materials removed from Work not identified for re-use.

2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, heat-resistant assembly.

.3 Operating conditions: 0-40 degrees C with 10-90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

2.2 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:

.1 Thermocouples: limit to temperature range of 200 degrees C and over.

.2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored lead wires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.3 Sensing element: hermetically sealed.

.4 Stem and tip construction: copper or type 304 stainless steel.

.5 Time constant response: less than 3 seconds to temperature change of 10 degrees C.

.6 Immersion wells: NPS 3/4, stainless-steel spring-loaded construction, with heat transfer compound compatible with sensor. Insertion length 100mm as indicated.

.2 Room temperature sensors and display wall modules.

.1 Temperature sensing and display wall module.

.1 LCD display to show space temperature ed and temperature setpoint.

.2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.

.3 Jack connection for plugging in laptop personal computer contractor supplied palm compatible handheld device for access to zone bus.

.4 Integral thermistor sensing element 10,000 ohm at 24 degrees.

.5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.

.6 Stability 0.02 degrees C drift per year.

.7 Separate mounting base for ease of installation.

.2 Room temperature sensors.

.1 Wall mounting, in slotted type covers having brushed stainless steel finish, with guard as indicated.

.2 Element 10-50mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000-ohm, accuracy of plus or minus 0.2 degrees C.

.3 Duct temperature sensors:

.1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length 460mm,

.2 Averaging duct type incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6096 mm. Bend probe at field installation time to 100mm radius at point along probe without degradation of performance.

.4 Outdoor air temperature sensors:

.1 Outside air type: complete with probe length 100 - 150mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.

.3 Output signal: 4 - 20 mA into500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full-scale output.

.7 Maximum current to 100- or 1000-ohm RTD sensor: not to exceed 25 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 degrees C.

.10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.

.11 Transmitter ranges: select narrowest range to suit application from following:

.1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.

.2 0 to 100 degrees C, plus or minus 0.5 degrees C.

.3 0 to 50 degrees C, plus or minus 0.25 degrees C.

.4 0 to 25 degrees C, plus or minus 0.1 degrees C.

.5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.4 HUMIDITY SENSORS

.1 Room and Duct Requirements:

.1 Range: 5-90 % RH minimum.

.2 Operating temperature range: 0 - 60 degrees C.

.3 Absolute accuracy:

.1 Duct sensors: plus, or minus 3 %.

.2 Room sensors: plus, or minus 2 %.

.4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.

.5 Maximum sensor non-linearity: plus, or minus 2% RH with defined curves.

.6 Room sensors: wall mounted as indicated.

.7 Duct mounted sensors: locate so that sensing element is in air flow in duct.

.2 Outdoor Humidity Requirements:

.1 Range: 0 - 100 % RH minimum.

.2 Operating temperature range: -50 to 40 degrees C.

.3 Absolute accuracy: plus, or minus 2%.

.4 Temperature coefficient: plus, or minus 0.03%RH/ degrees C over 0 to 50 degrees C.

.5 Must be unaffected by condensation or 100% saturation.

.6 No routine maintenance or calibration is required.

2.5 HUMIDITY TRANSMITTERS

.1 Requirements:

.1 Input signal: from RH sensor.

.2 Output signal: 4 - 20 mA onto 500-ohm maximum load.

.3 Input and output short circuit and open circuit protection.

.4 Output variations: not to exceed 0.2% of full-scale output for supply voltage variations of plus or minus 10 %.

.5 Output linearity error: plus, or minus 1.0% maximum of full-scale output.

.6 Integral zero and span adjustment.

.7 Temperature effect: plus, or minus 1.0 % full scale/ 6 months.

.8 Long term output drift: not to exceed 0.25 % of full-scale output/ 6 months.

2.6 PRESSURE TRANSDUCERS

.1 Requirements:

.1 Combined sensor and transmitter measuring pressure.

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500-ohm maximum load.

.3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full-scale output over entire range.

.5 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.

.6 Over-pressure input protection to at least twice rated input pressure.

.7 Output short circuit and open circuit protection.

.8 Accuracy: plus, or minus 1% of Full Scale.

2.7 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500-ohm maximum load.

.3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full-scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.8 STATIC PRESSURE SENSORS

.1 Requirements:

.1 Multipoint element with self-averaging manifold.

.1 Maximum pressure loss: 160Pa at 10 m/s. (Air stream manifold).

.2 Accuracy: plus, or minus 1% of actual duct static pressure.

2.9 STATIC PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 150 % of duct static pressure at maximum flow.

.3 Accuracy: 0.4 % of span.

.4 Repeatability: within 0.5 % of output.

.5 Linearity: within 1.5 % of span.

.6 Dead band or hysteresis: 0.1% of span.

.7 External exposed zero and span adjustment.

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

2.10 VELOCITY PRESSURE SENSORS

.1 Requirements:

.1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.

.2 Maximum pressure loss: 37Pa at 1000 m/s.

.3 Accuracy: plus, or minus 1 % of actual duct velocity.

2.11 VELOCITY PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500-ohm maximum load.

.2 Calibrated span: not to exceed 125 % of duct velocity pressure at maximum flow.

.3 Accuracy: 0.4 % of span.

.4 Repeatability: within 0.1 % of output.

.5 Linearity: within 0.5% of span.

.6 Dead band or hysteresis: 0.1% of span.

.7 External exposed zero and span adjustment.

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.12 LIQUID AND STEAM FLOW METERS

.1 Requirements:

.1 Pressure rating: as specified in I/O summaries.

.2 Temperature rating: as specified in I/O summaries.

.3 Repeatability: plus, or minus 0.2 %.

.4 Accuracy and linearity: plus, or minus 1.0 %.

.5 Flow rangeability: at least 10:1.

.6 Body material: SS316

.7 Ends:

.1 NPS 2 and under screwed.

.2 NPS 2.1/2 and over: flanged.

2.13 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:

.1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.

.2 Adjustable setpoint and differential.

.3 Switch: snap action type, rated at 24 V DC.

.4 Switch assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 2% repetitive switching.

.6 Provide switches with isolation valve and snubber, where code allows, between sensor and pressure source.

.7 Switches on steam and high temperature hot water service: provide pigtail syphon.

2.14 TEMPERATURE SWITCHES

.1 Requirements:

.1 Operate automatically. Reset automatically, except as follows:

.1 Low temperature detection: manual reset.

.2 High temperature detection: manual reset.

.2 Adjustable setpoint and differential.

.3 Accuracy: plus, or minus 1degrees C.

.4 Snap action rating: 24V DC as required. Switch to be DPST for hardwire and EMCS connections.

.5 Type as follows:

.1 Room: for wall mounting on standard electrical box with protective guard as indicated.

.2 Duct, general purpose: insertion length = 460 mm.

.3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

.4 Low temperature detection: continuous element with 6096 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.

.5 Strap-on: with helical screw stainless steel clamp.

2.15 TANK LEVEL SWITCHES

.1 Requirements:

.1 Indicate high/low water level and to alarm.

.2 For mounting on top of tank.

.3 Maximum operating temperature: 120 degrees C.

.4 Snap action contacts rated 15 amp at 120 V.

.5 Adjustable setpoint and differential.

2.16 SUMP LEVEL SWITCHES

.1 Requirements:

.1 Liquid level activated switch sealed in waterproof and shockproof enclosure.

.2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.

.3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

.1 Mast: aluminum, size and height as indicated.

2.17 SOLENOID CONTROL AIR VALVES

.1 Coil: 24V DC, as indicated.

.2 Capacity: to pass a minimum of 0.15 l/s air at 140 kPa differential.

2.18 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

2.19 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.

.2 Coils: rated for 120V AC Other voltage: provide transformer.

.3 Contacts: rated at 5 amps at 120 V AC.

.4 Relay to have visual status indication.

2.20 SOLID STATE RELAYS

.1 General:

.1 Relays to be socket or rail mounted.

.2 Relays to have LED Indicator

.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.

.4 Operating temperature range to be -20 degrees C to 70 degrees C.

.5 Relays to be CSA Certified.

.6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.

.7 Operational frequency range, 45 to 65 HZ.

.2 Input:

.1 Control voltage, 3 to 32 VDC.

.2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.21 CURRENT TRANSDUCERS

.1 Requirements:

.2 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:

.1 4-20 mA DC.

.2 0-1 volt DC.

.3 0-10 volts DC.

.4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.22 CURRENT SENSING RELAYS

.1 Requirements:

.1 Suitable to detect belt loss or motor failure.

.2 Trip point adjustment, output status LED.

.3 Split core for easy mounting.

.4 Induced sensor power.

.5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.

.6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.

.7 Adjustable latch level.

2.23 CONTROL DAMPERS

.1 Construction: blades, see mechanical drawings. Three or more sections to be operated by jack shafts.

.2 Materials:

.1 Frame: 2.03 mm minimum thickness extruded aluminum. For outdoor air and exhaust air applications, frames to be insulated.

.2 Blades: extruded aluminum. For outdoor air/exhaust air applications, blades to be internally insulated.

.3 Bearings: maintenance free, synthetic type of material.

.4 Linkage and shafts: aluminum, zinc and nickel-plated steel.

.5 Seals: synthetic type, mechanically locked into blade edges.

.1 Frame seals: synthetic type, mechanically locked into frame sides.

.3 Performance: minimum damper leakage meets or exceed AMCA Standard 500-Dratings.

.1 Size/Capacity: refer to damper schedule.

.2 25 L/s/m^2 maximum allowable leakage against 1000 Pa static pressure for outdoor air and exhaust air applications.

.3 Temperature range: minus 40degrees C to plus 100 degrees C.

.4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

.5 Jack shafts:

.1 25 mm diameter solid shaft, constructed of corrosion resistant metal complete with required number of pillow block bearings to support jack shaft and operate dampers throughout their range.

.2 Include corrosion resistant connecting hardware to accommodate connection to damper actuating device.

.3 Install using manufacturers installation guidelines.

.4 Use same manufacturer as damper sections.

2.24 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Requirements:

.1 Direct mount proportional type as indicated.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.

.4 Power requirements: 5 VA maximum at 24 V AC.

.5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.

.6 For VAV box applications floating control type actuators may be used.

.7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.25 CONTROL VALVES

.1 Body: globe style

.1 Flow characteristic as indicated on control valve schedule.

.2 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.

.3 Normally open or Normally closed, as indicated.

.4 Two or three port, as indicated.

.5 Leakage rate ANSI class IV, 0.01% of full open valve capacity.

.6 Packing easily replaceable.

.7 Stem, stainless steel.

.8 Plug and seat, bronze.

.9 Disc, replaceable, material to suit application.

.10 NPS 2 and under:

.1 Screwed National Pipe Thread (NPT) tapered female connections.

.2 Valves to ANSI Class 250, valves to bear ANSI mark.

.3 Rangeability 50:1minimum.

.11 NPS 2½ and larger:

.1 Flanged connections.

.2 Valves to ANSI Class as indicated, valves to bear ANSI mark.

.3 Rangeability 100:1minimum.

.2 Butterfly Valves NPS 2 and larger:

.1 Body: for chilled water ANSI Class 150 cast iron lugged body and wafer body installed in locations as indicated. For steam and heating water ANSI Class 150 carbon steel lugged body and wafer body.

.2 End connections to suit flanges that are ANSI Class 150.

.3 Extended stem neck to provide adequate clearance for flanges and insulation.

.4 Pressure limit: bubble tight sealing to 170 kilopascals.

.5 Disc/vane:316 stainless steel Seat: for service on chilled water PTFE (polytetrafluoroethylene). For service on steam and heating water PTFE.

.6 Stem: 316 stainless steel.

.7 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.

.8 Flow characteristic linear.

.9 Maximum flow requirement as indicated on control valve schedule.

.10 Maximum pressure drop as indicated on control valve schedule: pressure drop not to exceed one half of inlet pressure.

.11 Normally open or Normally closed , as indicated.

.12 Valves are to be provided complete with mounting plate for installation of actuators.

2.26 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Control signal: 4-20 mA DC.

.3 Positioning time: to suit application. 90 sec maximum.

.4 Fail to normal position as indicated.

.5 Scale or dial indication of actual control valve position.

.6 Size actuator to meet requirements and performance of control valve specifications.

.7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

.8 Minimum shut-off pressure: refer to control valve schedule.

2.27 SURFACE WATER DETECTORS

.1 Requirements:

.1 Provide alarm on presence of water on floor.

.2 Expendable cartridge sensor.

.3 Internal waterproof switch.

.4 One set of dry contacts 2 amps at 24 V.

.5 Unaffected by moisture in air.

.6 Self-powered.

2.28 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as indicated to handle requirements with additional space to accommodate 25% additional capacity as required by Consultant Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.29 WIRING

.1 In accordance with Section 26 27 10 - Modular Wiring System, 26 27 26 - Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #18AWG

.2 Analog input and output: shielded #18 minimum solid copper stranded twisted pair.

3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturers and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures, and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping provide space for fire stopping in accordance with Section 07 84 00 - Fire stopping. Maintain the fire-resistance rating integrity of the fire separation.

.6 Electrical:

.1 Complete installation in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.3 Refer to electrical control schematics included as part of control design schematics on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Consultant Representative before beginning Work.

.4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.5 Install communication wiring in conduit.

.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduits fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Consultant Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

3.2 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

.1 Protect from solar radiation and wind effects by non-corroding shields.

.2 Install in NEMA 4 enclosures.

.4 Duct installations:

.1 Do not mount in dead air space.

.2 Locate within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 305 mm from top of ductwork. Each additional horizontal run to be no more than 305 mm from one above it. Continue until complete cross-sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.2 Wire multiple sensors in series for low temperature protection applications.

.3 Wire multiple sensors separately for temperature measurement.

.4 Use software averaging algorithm to derive overall average for control purposes.

.6 Thermowells: install for piping installations.

.1 Locate well in elbow where pipe diameter is less than well insertion length.

.2 Thermowell to restrict flow by less than 30%.

.3 Use thermal conducting paste inside wells.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 MAGNEHELIC PRESSURE INDICATORS

.1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensor as reviewed by Consultant Representative.

.2 Locations: as indicated.

3.5 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.

.1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.6 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.7 AIR PRESSURE GAUGES

.1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

.2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.8 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.9 AIR FLOW MEASURING STATIONS

.1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.10 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Programming and configuration of site-specific requirements for sequences of operation to meet the Project's operational criteria.

.2 Work results related to Division 25. Sequences of operation described in this section solely relate to physical and logical points under control and supervision of the integrated automation system.

.1 Third-party systems and packaged equipment with built-in controls are assumed to be provided with preprogrammed routines or configurable operating modes with which the integrated automation system interacts.

.2 Achieving a fully functional system compliant with the described sequences of operation extends beyond programming. It may include providing hardwire interlocks, adjusting instrument and control device settings, and modifying configuration parameters in third-party systems or equipment.

.1 Work specified in this section closely relates to equipment and work results specified in other sections of Division 25. Read this section in conjunction with:

.1 The System Architecture Diagram provided on Drawings, showing requirements for systems and equipment to communicate and exchange data.

.2 Instrumentation and control device requirements in other sections.

1.2 RELATED REQUIREMENTS

.1 Section 25 01 11 – EMCS: Start -Up, verification and Commissioning.

.2 Section 25 05 010 – EMCS: General Requirements

.3 Section 25 30 01 – EMCS: Building Controllers

1.3 REFERENCE STANDARDS

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

.1 ASHRAE Guideline 36-2021, High Performance Sequences of Operation for HVAC Systems

.2 ASHRAE/IES 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Integrated Systems: Coordinate system interfaces connecting to integrated automation equipment with other Subcontractors, manufacturers, and suppliers to verify compliance with intended sequences of operation.

.2 Review submittals of third-party equipment and notify the representative consultant when the proposed interface will affect the intended sequences of operation.

.3 Review third-party products and coordinate with trades to resolve integration issues and propose corrections.

.2 Coordinate with Section 25 30 01 – Building Automation Controllers for software requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit sequences of operation during Shop Drawing review in accordance with Section 01 33 00 – Submittal Procedures and Section 25 05 02-EMCS: Submittals and Review Process.

.2 Integrated Systems: Submit proposed changes to system interface and sequences of operation to the representative of consultant for review.

1.6 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals and Section 25 05 01 – EMCS: General Requirements.

.2 Record Documentation: Submit recorded changes made to sequences of operation during construction and commissioning activities in accordance with Section 25 05 01 – EMCS: General Requirements.

.1 Submit a copy of sequences of operation in Microsoft Word format so changes can be made and saved by Owner's personnel. Protect files to prevent modifications by unauthorized users.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Programmers: Personnel specialized in configuring and commissioning this type of installation with five years of experience.

.2 Programmers to provide all control stratagems to ensure systems operate in a safe and efficient manner. Include delays, ramps, reset functions, interlocks, and cascade loops.

2 Products

2.1 NOT USED

.1 Not used.

3 Execution

3.1 PROGRAMMING CRITERIA

.1 Incorporate the following programming criteria when programming the sequences of operation:

.1 Setpoints, Schedules, and Calendars:

.1 Provide ability to adjust setpoints, schedules, and calendars without requiring program modifications.

.2 Operations and maintenance (O&M) staff with proper authorization levels can adjust setpoints, schedules, and calendars.

.3 Determine optimal setpoints, hours of operation, and calendar during commissioning phase, and complete adjustments.

.2 Operation Modes, Parameters, and Constants:

.1 Operator personnel with proper authorization level to have the ability to switch operating modes (such as occupied or unoccupied) and modify parameters, constants, and time delays without requiring programming modifications.

.3 Control Loops:

.1 Provide proportional and integral (PI) type control loops except as follows:

.1 Flow and pressure control loops: Proportional, integral, and derivative (PID) type.

.2 Limit control loops: Proportional type.

.2 Adjust control loops to provide stable operating system during extreme conditions.

.4 Starting Ramps:

.1 Incorporate control ramps during system start-up, or after a setpoint adjustment, to gradually bring control points to their setpoint values, preventing risks such as freezing, low pressure, and high pressure.

.2 Incorporate additional control ramps required for system operation or as requested by the representative of consultant during start-up and commissioning.

.3 All control ramp rates to be adjustable.

.5 Alarms and Events:

.1 Alarm messages: Include timestamp, date, alarm level and description, equipment tags for involved components, and potential alarm trigger.

.2 Sensor failure: When a sensor failure is detected, the system is to disable the associated input point and transition dependent control points to a safe state.

.3 Alarm suppression: Interlock sensors located in ductwork or in hydronic system sensors with corresponding system statuses (such as fans, pumps, etc.) to suppress alarms when system is not operational.

.4 Analog alarms: Program two high-level alarms and two low-level alarms for each analog point. First alarm level to set operational limit and second alarm level to indicate measurement is out of range.

.5 Critical alarms: Program the following critical alarms when status is available.

.1 Equipment status does not match command (unauthorized on/off).

.2 Freeze risk.

.3 High and low pressure.

.4 Equipment fault status.

.5 Abnormal conditions (temperature, pressure, level).

.6 Maintenance alarms: Program the following alarms when status is available.

.1 Equipment alarm or trouble status.

.2 Equipment maintenance alarm.

.3 Dirty filters; coordinate setpoint values with Division 23.

.4 Equipment runtime limit.

.7 Motor Control:

.1 Equipment runtimes:

.1 Totalized and displayed on system graphical user interface.

.2 When runtime data is used for generating maintenance alarms or managing equipment rotation sequences, implement a separate logical point to reset the runtime to zero once it reaches a defined value.

.2 Rotation sequence selector for lead/lag and duty/standby operation:

.2 Program a selector switch on the graphical user interface to enable user to modify the rotation sequence and to manage equipment runtimes.

.8 Motor Interlocks:

.1 Abnormal “on” condition:

.1 Controller to enable control and execute sequence of operations of equipment if system is manually started (for example, motor starter in “hand” position).

.2 Abnormal “off” condition:

.1 When a controller detects a failed start or unexpected shutdown, system is turned off and locked out, after an adjustable delay, to prevent motor operation without a load (for example, broken drive belt) and to protect equipment.

.2 On lockout, the controller to immediately send a signal to control system loops to set field devices back to their shutdown state.

.3 Incorporate a manual reset button on the graphical user interface to restart the system and permit lockout function in or out of service.

.3 Programs and direct digital control (DDC) type controls to not override any safety interlocks.

.9 Starting After a Power Failure:

.1 Once power is restored, electro-mechanical equipment to restart in accordance with a predefined sequence to avoid power overload and control peak demand. Provide programmable start-up delay for each piece of equipment controlled.

.2 Systems equipped with low-power motors may be grouped under the control of a unique delay command. Total power (kW) to be the same and not exceed a maximum value for any group.

3.2 ADVANCED SEQUENCES OF OPERATION

.1 Provide refinements to sequences of operation described in this section to incorporate programming requirements described in ASHRAE Guideline 36.

.2 Energy Management Sequences:

.1 Implement the following energy management sequences when programming the sequences of operation described in this section.

.2 Optimized start routines:

.1 Used to start air handling systems before the defined occupancy schedule to pre-heat or pre-cool the related space in anticipation of occupancy. Start times are determined by the centralized building management system (BMS) to bring space temperatures to setpoint on schedule.

.2 Pre-heat start: Air-handling systems bring space temperatures to their occupied setpoint with their mixing dampers in "full recirculation" position.

.3 Pre-cool start: Air-handling systems bring space temperatures to their occupied setpoint with their mixing dampers in "full recirculation" position. When outdoor conditions are favourable (temperature or enthalpy-based conditions), air-handling systems use free-cooling to perform pre-cool sequence.

.3 Supply air temperature reset:

.1 Provide a supply air temperature reset strategy for designated air-handling systems.

.2 Supply air temperature setpoints: Reset based on criteria specific to each system and application. Confirm setpoint reset schedules and setpoint limits for each system designated to use this strategy.

.3 Supply air temperature reset strategy to use one of the following control stratagems:

.1 For single-zone systems:

.1 Reset the supply air temperature setpoint based on space temperature or the average space temperature when multiple space temperature sensors are deployed to cover a large open space.

.2 In the absence of space temperature sensors, reset the supply air temperature setpoint based on the return air temperature.

.2 For multi-zone systems:

.1 Reset the supply air temperature setpoint to satisfy the zone with the highest demand for cooling as determined by terminal unit damper positions and terminal unit reheat status.

.4 Supply air static pressure reset:

.1 Provide a supply air static pressure reset strategy for designated air-handling systems to optimize supply fan operation in accordance with ASHRAE/IES 90.1.

.2 Requirements:

.1 Connect supply air static pressure signal directly to the controller providing control of the air-handling system to ensure adequate control loop response time.

.2 Provide a proportional–integral–derivative (PID) loop to control the supply fan speed based on the static pressure setpoint.

.3 Reset the supply air static pressure setpoint using the output of a direct-acting PID loop to a setpoint range.

.4 The supply air static pressure setpoint modulates within a specified range by polling the damper positions of terminal units located downstream and ensuring that the terminal units with the highest demand have damper positions between 85% and 95% open (adjustable).

.2 Adjust the acceleration setting, deceleration setting, minimum fan speed, and supply air static pressure setpoint range (high and low) during start-up to achieve stable control system performance.

3.3 SEQUENCES OF OPERATION FOR PLUMBINGHYDRONIC (HEATING AND COOLING) VENTILATIONLIGHTING SYSTEMS

.1 BMS control panel is in mechanical room.

.2 Storage rooms, Unit heaters UH- 4,5,6,7:

.1 Unit heaters will be controlled by wall mounted -T-stats, low voltage, rating to suit unit heater, lock cover, set point locking device, concealed adjustment, plastic cover and guard, energy star certified.

.2 If room temperature drops 1.5°C (adjustable) below the set point, the two-way control valves will be open, heating water will be supplied to the unit heaters, until the room temperature reaches to its set point 18°C(adjustable).

.3 Corridor area

.1 Forced flow heaters FF -1 (ceiling mounted) and FF-2 (floor mounted) are serving corridor space. Temperature is controlled by wall mounted T-stat, if the space temperature drops 1.5°C(adjustable) below the set point, the two-way control valves will be open, the fan will be running till the space temperature reaches the set point.

.4 Communication room

.1 In summertime: Cooling will be supplied by the split AC package. Room temperature will be controlled by wall mounted T-stat.

.2 In wintertime: Duct mounted heating coil HC-2 is added to the AC supply air duct. If room temperature is lower than 16.5°C(adjustable), the two-way control valve on the heating coil HC-2 will be activated to heat the room until the room temperature reaches to the set point 18°C(adjustable).

.5 Electrical room

.1 During shoulder season, if the room temperature is = or >29°C(adjustable), the motorized damper in the supply duct will be open, supply fan SF-1 will be turned on, outdoor air will be supplied to the electrical room and will be relieved from the room, until the room temperature reaches to the set point 27.5°C(adjustable).

.2 In Summertime, Split AC is in the electrical room, room temperatures will be controlled by wall mounted T-stats.

.3 In wintertime: Duct mounted heating coil HC-1 is added to the AC supply air duct. If room temperature is lower than 16.5°C(adjustable), the two-way control valve on the heating coil will be activated to heat the room until reaches to the set point 18°C(adjustable).

.6 Car wash equipment room

.1 Split AC is in the room. Room temperature will be controlled by wall mounted T-stats.

.2 Unit heater is to provide heating to the room, if room temperature is lower than 16.5°C(adjustable), the two-way control valves on the unit heater will be activated to heat the room until it reaches to the set point 18°C(adjustable).

.3 ERV -2 in this room will provide constant treated outdoor air to this room and exhaust to outside in wintertime, it will be untreated outdoor air in summertime. The ERV will be operated on 24/7.

.7 Wash bay 12,13,14,15:

.1 In-slab heating and infrared heaters are in the rooms. Room temperature will be controlled by the wall mounted t-stats, if the in-slab heating can't provide enough heat, the infrared heater will be started.

.2 MUA- 1 & EF-1, MUA- &EF-2, MUA-3 &EF-3, MUA-4 &EF-4 are interlocked.

.3 Unoccupied mode: if CO/NO2 concentration lower than 25ppm (CO)/0.7ppm (NO2), RH< 60%(adjustable), T-stat will control the room temperature. Ventilation system will be off.

.4 Occupied mode: When the wash bay entrance door opens, the air curtain on the door will be on, the MUA and the EF for this bay will run at lower speed, and the ceiling fan will be turned on, When the car wash process is completed, the exit door opens, the exist air curtain is on, MUA &EF will be running 10 more mins(adjustable). If CO/NO2, RH levels are in an unacceptable range, the MUA&EF will keep working at high speed until CO/NO2, RH levels drop to 30ppm (CO)/ 0.5ppm (NO2), RH65(adjustable). If CO/NO2 level reaches the alarm 50ppm (CO)/1.0 PPM (CO2), both entrance and exit overhead doors open to have enough ventilation, until CO/NO2 level drop to safe range.

.8 Wash bay 12,13,14,15:

.1 In-slab heating and infrared heaters are in the rooms. Room temperature will be controlled by the wall mounted t-stats, if the in-slab heating can't provide enough heat, the infrared heater will be started.

.2 MUA- 1 & EF-1, MUA- &EF-2, MUA-3 &EF-3, MUA-4 &EF-4 are interlocked.

.3 Unoccupied mode: if CO/NO2 concentration lower than 25ppm (CO)/0.7ppm (NO2), RH< 60%(adjustable), T-stat will control the room temperature. Ventilation system will be off.

.4 Occupied mode: When the wash bay entrance door opens, the air curtain on the door will be on, the MUA and the EF for this bay will run at lower speed, and the ceiling fan will be turned on, When the car wash process is completed, the exit door opens, the exist air curtain is on, MUA &EF will be running 10 more mins(adjustable). If CO/NO2, RH levels are in an unacceptable range, the MUA&EF will keep working at high speed until CO/NO2, RH levels drop to 50ppm (CO)/ 1.0 ppm (NO2), RH65(adjustable). If CO/NO2 level reaches the alarm 100ppm (CO)/1.5 PPM (CO2), both entrance and exit overhead doors fully open to have enough ventilation, until CO/NO2 level drop to safe range.

.9 Driveway for 4 wash bays -snow melting system.

.1 Boiler B-3 is dedicated to the snow melting system. Manifold 1,2,3,4 will be serving each driveway area. The temperature sensors will be in the driveway to detect falling or blowing precipitation before snow or ice begin to form, allowing the control to begin managing the system. A snow melt system panel will be in the mechanical room.

.10 In-slab heating system B-4

.1 Boiler B-4 is dedicated for the 4 wash bays in-slab heating system with 50% glycol. Recirculation pumps P-3, P-4, P-5, P-6 will be serving the wash bay 11,12,13,14 individually. The temperature sensors will be in each bay to control room temperature.

.11 General heating B-1 &B-2.

.1 Boiler 1& B-2, recirculation pump P-1, &P-2 will be serving general heating with 50% glycol. The heating water will serve unit heaters, baseboard heaters, duct mounted heating coils, ERV pre-heat, after-heat coils and forced flow heaters. Boiler control refer to manufacturer’s O&M manual and specification boiler section.

.12 General ventilation ERV-1

.1 ERV-1 is in mechanical room, will provide general ventilation for the storage rooms, corridor, electrical room, communication room, washroom, and janitor room. The unit will run 24/7. The unit will supply 20°C in wintertime, 25°C in summertime.

.13 Mechanical room heating and ventilation.

.1 UH -1&UH-2, EF-5 will be controlled by a wall mounted T-stat to provide heating and cooling for the room. In wintertime unit heaters will provide heating. When the room temperature drops 1.5°C (adjustable), two-way control valve will open, fan starts till the room temperature reaches to the set point.

.2 During shoulder season and summertime, if the room temperature higher than the set point 1.5°C(adjustable), the motorized damper on the outdoor air intake will be open, EF-5 starts, until the room temperature drops to its set point.

3.4 ADJUSTING

.1 Modify sequences of operation to improve system stability and equipment protection, as requested by the representative of consultant.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 00 50

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000 , The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets.

.3 Submit for review single line electrical diagrams and locate as indicated.

.1 Electrical distribution system in main electrical room and where are indicated on drawings.

.4 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm monitoring station.

.5 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit drawings and product data.

.6 If changes are required, notify Representative and Consultant of these changes before they are made.

.6 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such material and equipment to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Representative and Consultant.

.7 Manufacturer's Field Reports: submit to Consultant and Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 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 Store materials in dry location, indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan and Waste Reduction Workplan related to this Scope of Work.

.5 Packaging Waste Management: remove and return to manufacturer for proper reuse or disposal.

2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification labels and nameplates for control items in English and French.

.4 Use one nameplate and label for each language.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with manufacturers recommendations.

.2 Equipment and Material to be CSA certified. Where CSA certified equipment and material are not available, obtain special approval from both inspection authorities and authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Representative.

.2 Decal and Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with labels and nameplates as follows:

.1 Nameplates: lamicoid 3mm, black face, white lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

.3 Wording on labels and nameplates to be approved by Consultant and Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per label and nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered , on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow
Control Wiring	Orange	

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for

.1 Visually inspect substrate in presence of Consultant and Representative.

.2 Inform Consultant and Representative 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 and Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32- Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

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

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1500 mm.

.6 Fire alarm stations: 1500 mm.

.7 Fire alarm bells: 2100mm.

.8 Television outlets: 300 mm.

.9 Wall mounted speakers: 2100 mm.

.10 Clocks: 2100 mm.

.11 Door bell pushbuttons: 1500 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00- Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm, fire alarm monitoring and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Check resistance to ground before energizing.

.3 Carry out tests in presence of Consultant and Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 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.

3.9 SYSTEM STARTUP

.1 Instruct Consultant and Representative in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with site requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with site requirements.

.3 Waste Management: separate waste materials for recycling and disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 21 Wires and Cables (0-1000V)

.2 Section 26 05 22 Connectors and Terminations

.3 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA-C22.2, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 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 Store materials indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to NEMA to consist of:

.1 Connector body and stud clamp for round conductors' copper stranded.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.5 Sized for tubes, bars and conductors as indicated.

.4 Clamps or connectors for flexible conduit, aluminum sheathed cable, armoured cable, mineral insulated cable, non-metallic sheathed cable and TECK cable as required to: CAN/CSA-C22.2.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and Representative.

.2 Inform Consultant and Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied Consultant and Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors cables and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2 and NEMA.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with site required conditions.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 22 Connectors and Terminations

.3 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, packaging materials and crates in accordance with Section Clients Waste Management and Disposal.

2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE, RW90 XLPE, Jacketed.

.3 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon, TWU, TWH rated at 600 V.

.4 Neutral supported cable: 3 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90, NS75 Insulation: Type NS-1 rated 300 V, Type NSF-2 flame retardant rated 600 V.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper as indicated.

.2 Circuit conductors: copper as indicated; size as indicated.

.3 Insulation:

.1 Ethylene propylene rubber EP.

.2 Cross-linked polyethylene XLPE.

.3 Rating: 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: galvanized steel interlocking aluminum flat.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

.1 One hole aluminum, steel, zin, malleable iron straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless copper sheath, Type LWMI rated 300 V, 250 degrees C and Type M1 rated 600 V, 250 degrees C.

.4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project, wet locations.

.5 Two-hour fire rating.

.6 Connectors: watertight, factory installed and tested approved for MI cable.

.7 Termination kits: factory installed approved for MI cable.

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90 and ACL90 - lead sheath over cable assembly and under armour.

.3 Armour: interlocking type fabricated from aluminum or galvanized steel strip.

.4 Type: PVC, flame retardant and ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project in wet locations.

.5 Connectors: anti short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Not Used.

2.6 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket, cotton braid, and armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: stranded, solid annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: TWH, PVC, TW, TW 40 degrees C, polyethylene.

.2 Shielding: metallized tapes, tape coated with paramagnetic material, braid wire, tape coated with diamagnetic material over each conductor group.

.3 Overall covering: flat galvanized steel, lead sheath, polyethylene jackets, interlocked armour of, aluminum sheath, aluminum strip, PVC jackets, copper strip.

.3 Type: 600 V conductors, sizes as indicated: semi-annealed aluminum, annealed copper.

.1 Insulation: TW, PVC, TWH, TW 40 degrees C, RW75 butyl rubber insulation type, R90, R90 (EP), polyethylene, ethylene-propylene rubber insulation type, R90 (x-link), RW90 (x-link), cross-linked polyethylene type, RW90 (EP), RW75 (x-link), RW75 (EP).

.2 Shielding: conductors.

.3 Overall covering: thermosetting jackets, PVC, and jacket over sheath of, thermoplastic jacket.

2.7 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMW, NMD90XLPE, NMWU, NMD90 nylon, size as indicated.

3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests for local authority having jurisdiction over installation. Consultant and Representative.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by straps and/or hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable concealed, securely supported by straps and/or hangers.

.2 Support 2-hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

3.9 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

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

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from Consultant and Representative and include it with maintenance manuals and as-built drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.5 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 Store materials indoors, in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Not Used.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and Departmental Representative.

.2 Inform Consultant and Representative 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 and Representative.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with site requirements.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with site requirements.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 0.4 – Bonding Electrical Equipment (Protective Grounding).

.2 CSA C22.2 No. 41 – Grounding and Bonding Equipment.

.3 CSA C22.1 – Canadian Electrical Code, Part 1.

1.2 WORK INCLUDED

.1 Supply and install complete secondary grounding system and equipotential bonding system. Securely and adequately ground all components of electrical system in accordance with requirements of all related sections in Canadian Electrical Code, Alberta Building Code and local Electrical Inspection Branch.

.2 System is to consist of cables, ground rods, supports, and all necessary materials and inter-connections to provide a complete system.

.3 Measured resistance to ground of system network to not exceed 5 ohms.

.4 All ground conductors shall be run in conduit unless specifically stated otherwise.

.5 All branch circuit conduits shall contain a green ground conductor, regardless if the conduit is metal or not.

1.3 RELATED WORK

.1	Underground Services	Section 26 05 44
.2	Service Distribution	Section 26 24 13
.3	Dry Type Transformers up to 600V Primary	Section 26 22 13
.4	Bonding Study for Swimming Pools	Section 26 05 26

2 Products

2.1 EQUIPMENT

.1 Grounding or Bonding conductors to be stranded copper TWH complete with green jacket or green with yellow stripe jacket unless otherwise indicated.

.2 Uninsulated ground wires to be bare stranded copper, tinned, soft annealed. Size as indicated.

.3 Copper conductor: minimum 6 m long for each ground electrode, bare, stranded, tinned, soft annealed.

.4 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.

.5 Cable to pipe connectors made with Burndy GAR connectors.

.6 In main electrical room, provide copper ground bar at 1800mm or lower, complete with lugs suitable to terminate all ground cables plus 25% spare space capacity for future.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Bonding jumpers, straps.
.5 Pressure wire connectors.
.6 Inspection wells.
.7 Connections to be spray sealed.

.8 Bonding Connections:
.1 Below grade, in concrete:
.1 Mechanical compression fitting system that meets IEEE 837-2014 requirements.
.2 Connections to be spray sealed.

3 Execution

3.1 INSTALLATION

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, accessories. Where conduit is used, run ground wire in conduit. All connectors to be installed in accordance with manufacturers requirements. All frames and metallic enclosures of all electrical equipment and electrically operated equipment to be grounded through conduit system or via ground wire.

.2 All panelboards fed from main distribution centre to be grounded by grounding conductors sized in accordance with Canadian Electrical Code. Ground wire to be terminated at each end with appropriate grounding lug which be connected to equipment ground bus. Ground wire to be green TWH. Use mechanical connectors for grounding connections to equipment provided with lugs.

.3 All panels such as lighting panels, local distribution panels, etc., to be grounded with green ground wire run back to panel from which it is fed. Ground conductor to be sized according to Canadian Electrical Code.

.4 Connect using #4/0 bare copper conductors from main electrical room ground bus to a minimum of 4 ground rods located adjacent to main distribution centre. Test system for ground resistance before connecting utility ground and install additional ground rods as necessary to meet minimum requirements.

.5 All distribution centres and panels requiring equipment grounds to contain ground bus of adequate size and tapped for lugs for ground wire required.

.6 All underground connections are to use a compression connection system meeting IEEE 816 2018. Provide shop drawing for compression system for approval prior to use.

.7 All above ground bolted connections must be accessible and labeled with source and destination.

.8 Provide inspection wells for all system ground grid termination/connection locations.

.9 All motors to be grounded by means of adequately sized green ground wire contained within feeder conduit.

.10 All motors located in the Natatorium area are to be provided with shaft and frame bonding connections.

.11 Include separate green ground wire in all power conduits including branch circuit wiring sized to Canadian Electrical Code.

.12 Expansion joints and telescoping sections of raceways to be bonded using jumper cables as per Canadian Electrical Code.

.13 Connect all transformer neutrals to main building grounding loop wire.

.14 Install rigid conduit sleeves where ground wires pass through concrete slabs.

.15 Protect exposed grounding conductors from mechanical injury.

.16 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.17 Soldered joints are not permitted.

.18 Install separate ground conductor to all outdoor lighting standards.

.19 Connect building structural steel, metal siding and site flag poles to ground.

.20 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.21 Provide a #6 AWG ground conductor along the entire length of cable tray. Bond ground conductor to each section of tray or at minimum every 15 meters. Home run ground conductor back to main building ground bus.

.22 Provide an equipotential bonding and grounding system in the Aquatics and Spray Park areas as defined in Canadian Electrical Code Section 68.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter if appropriate.

.2 Install rod electrodes and make grounding connections.

.3 Bond separate, multiple electrodes together.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 347/600 V system.

3.4 EQUIPMENT BONDING

.1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, frames of motors & shafts, motor control centres, starters, control panels, building steel work, elevators, distribution panels, outdoor lighting.

.2 Provide a separate bonding conductor in all branch circuit raceways. Conduit shall not serve as a bond.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of all electrical rooms. Locate bus at 1800mm or below.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size #2/0 AWG.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for communication systems as detailed.

.1 Section 27 10 00 for Data and Voice Systems.

3.7 EQUIPOTENTIAL BONDING:

.1 Prior to basin concrete pour and post basin concrete pour provide equipotential bonding installation, testing and verification as shown on the electrical drawings, required by the CEC and specified in Section 26 05 26.

3.8 FIELD QUALITY CONTROL

.1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

.2 Perform tests prior to energizing the electrical system.

.3 Disconnect ground fault indicator during tests.

END OF SECTION

1 General

1.1 WORK INCLUDED

.1 Supply and install all hangers, supports and inserts for the installation shown on drawings and specified herein, as necessary to fasten electrical equipment securely to building structure.

2 Product

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Intermediate duty supporting structures to employ P1000 Unistrut or equal together with manufactures connecting components and fasteners for complete system.

.2 Heavy duty supporting structures to be fabricated and welded from steel structural members and prime painted before installation.

.2 Finishes:

.1 Outdoors, wet locations: Hot dipped galvanized.

.2 Indoors, dry locations: Galvanized when available, prime painted if not available.

.3 Indoors, aquatics area: Nickel based alloy or PVC

.4 Nuts, bolts, machine screws: Cadmium plated.

.3 Unistrut:

.1 Section P1000 or as required for load and span, with mounting screws, or approved. P1000 or equal is minimum standard for supporting conduits 50 mm and larger.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. All anchor bolts must be galvanized.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal.

2.3 NON-METALLIC ANCHORS

.1 Material: Plastic anchors for sheet metal screws.

.2 Manufacturer: Fischer.

2.4 CONDUIT SUPPORTS

.1 General: Malleable iron one-hole conduit straps where exposed to weather. Stamped steel two-hole straps indoors.

.2 Structural Steel: Crouse-Hinds "Wedgetite" supports or equivalent manufactured by Appleton.

.3 Masonry, concrete, stone, etc.: Anchors.

.4 Title: Toggle bolts.

.5 Metal studs, ceiling hangers, etc.: "Caddy-Clips".

.6 Unistrut: Unistrut conduit clamps.

2.5 CABLE SUPPORTS AND CLAMPS

.1 General: As per conduit supports, except that for single conductor cables, suitable non-ferrous, or approved stainless steel or aluminum clamps to be used.

3 Execution

3.1 WORKMANSHIP

.1 Do not cut or drill beams, joists or structural steel unless written permission of consultant is obtained.

.2 Distance between conduit or cable supports not to exceed code requirements.

.3 Supports to be suitable for real loads imposed by equipment.

.4 Do not support heavy loads from bottom chord of open web steel joists.

.5 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.6 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.

.7 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.8 Provide conduit rack with 25% spare capacity for multiple runs.

3.2 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces.

.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 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over 1 meter span and 8 mm over 2 meter span.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole malleable iron or steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 Use plastic anchors for light loads only. Use metal anchors for all other loads.

.9 Shot driven pins may only be used with written approval of the structural engineer.

.10 Use round or pan head screws for fastening straps, boxes, etc.

.11 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with minimum of four 6 mm fasteners.

.12 For surface mounting of two or more conduits use channels at 1.5 m oc spacing.

.13 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.14 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.15 Provide channel support with fittings for vertical runs of conduit and cables.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 22 Connectors and Terminations

.3 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

2 Products

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat and turned edge covers.

3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating voltage, phase, system name and source or as indicated.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, 25th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Submit samples for floor box in accordance with Section 01 33 00- Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturers recommendations.

2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster, tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry and multi, single gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Not Used.

2.6 CONDUIT BOXES

.1 Cast FS, aluminum, FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63mm with two double clamps to take non-metallic sheathed cables.

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.9 SERVICE FITTINGS

.1 Not Used.

3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 33 Raceway and Boxes for Electrical Systems

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1:21 – CEC Part 1 – Safety Standard for Electrical Installations.

.2 CAN/CSA-C22.2 No. 62-93(R2003), Surface Raceway Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00- Quality Control.

.1 Manufacturer's Instructions: provide manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.4 Indicate types of raceways with terminology similar to that used in this Section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

2 Products

2.1 SURFACE RACEWAY SYSTEM (WIRING PULLED IN)

.1 One piece steel, free of sharp edges to CAN/CSA-C22.2 No. 62.

.2 Corners, pull boxes, elbows, tees, two-piece assembly to facilitate site wiring.

.3 Finish: grey enamel.

.4 Switch, receptacle, extension boxes, adapters and fittings required for complete installation.

2.2 SURFACE RACEWAY SYSTEM (WIRING LAID IN)

.1 Two-piece steel assembly CAN/CSA-C22.2 No. 62.

.1 Finish: grey enamel.

.2 Switch, receptacle, extension boxes, adapters and fittings required for complete installation.

2.3 SURFACE FLOOR RACEWAY SYSTEM

.1 Two-piece steel assembly manufactured for floor lay-in type raceway to CAN/CSA-C22.2 No. 62.

.2 Finish: grey enamel.

2.4 CHANNEL RACEWAY

.1 Channel type raceway: to CAN/CSA-C22.2 No. 62, aluminum, perforated.

2.5 PLASTIC RACEWAY

.1 Plastic raceway: to CAN/CSA-C22.2 No. 62, rigid extruded polyvinyl chloride with slots on either side of raceway for exit of wiring.

.2 Channel: with solid snap-on cover throughout entire length.

2.6 FITTINGS

.1 Elbows, tees, supports, connectors couplings and fittings: to CAN/CSA-C22.2 No. 62.

3 Execution

3.1 INSTALLATION

.1 Install raceway systems as indicated and in accordance with manufacturer's instructions.

.2 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.

.3 Keep number of elbows, offsets and connections to minimum.

.4 Use wiring with mechanical protection in channel raceways.

.5 Install barriers in raceways for different services where required by code.

.6 Install wiring after installation of raceway system is complete.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1:21 – CEC Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.40-M1989(R2009), Cutout, Junction and Pull Boxes.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for raceway and boxes for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 61 00- Common Product Requirements.

.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 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect raceway and boxes from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SPLICE BOXES

.1 Splice boxes cast iron enclosures 6 mm thick painted with chromate primer and grey enamel to provide mechanical protection and moisture seal for direct buried cable splices rated 0.6 kV and consisting of:

.1 Two halves, split along cable axis, finely ground matching surfaces, fastened with galvanized steel bolts, top half with large filling holes with gasketted plugs for medium hard asphalt base compound, bottom half with screws on inside for bonding lead sheath, and box end openings sealed by:

.1 Wrapping cables with anhydrous tape and clamping to make snug fit, for 4 way splices.

.2 Fitting boxes with cable entrance fittings suitable for lead sheaths, for 4 way splices.

.2 Submarine splice boxes to provide mechanical protection and waterproof seal for submarine cables as follows:

.1 Galvanized steel pipe with filling holes for medium hard asphalt base compound, gasketted plugs, with ends right hand and left hand threaded, cast steel end caps with wire armour clamps, to relieve conductors and splice from mechanical stresses.

2.2 JUNCTION BOXES DISTRIBUTION LEVEL

.1 Welded steel rectangular boxes 6 mm thick minimum painted with chromate primer and grey enamel with removable plate on front side, designed for through run of main cable and porcelain enclosed disconnecting branches of 3 single conductor cables, using pothead plug and socket disconnectors enclosed in porcelain tubes and caps, standard designed for no voltage disconnecting, and for wall mounting in maintenance holes, branch cables rated 250A, 5 kV, filled with medium hard asphalt base compound.

2.3 JUNCTION BOXES POWER LEVEL

.1 Welded steel rectangular boxes, oil resistant gasketted steel plate lids fastened with silicon-bronze bolts, shot blasted and painted with chromate primer and grey enamel, cable heads medium hard asphalt compound filled cap nut sealed potheads with stuffing box entrances, air filled, disconnecting links insulated switch stick operated at no voltage rated 250A at 7500V, 4 way for wall mounting in maintenance holes.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for raceway and boxes installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Representative and Consultant.

.2 Inform Representative and 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 Departmental Representative and Consultant.

3.2 INSTALLATION

.1 Install splice boxes at cable joint, on floor of trench. Tighten armour clamps and fill with compound.

.1 Ground splice boxes as required.

.2 Install junction’s boxes on trench floor around cable splice to CSA C22.2 No.40. Connect cable terminals to box contacts.

.1 Ground junction boxes as required.

.2 Fasten lid securely and check for air leaks before trench is backfilled.

.3 Install distribution level steel boxes on walls of maintenance holes. Splice main cable in box and connect branch feeder. Fasten cover and fill with compound.

.1 Ground steel boxes as required.

.4 Install power level boxes as follows:

.1 Steel type: mount on wall of maintenance holes; connect cables to box terminals; install disconnect links, fasten lid securely check for air leaks.

.2 Ground power level boxes as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.2, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2, Rigid Metal Conduit.

.3 CSA C22.2, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2, Electrical Metallic Tubing.

.5 CSA C22.2, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2, Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling or reuse in accordance with Section Clients' Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum, galvanized steel, hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with expanded ends or with couplings.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal or steel aluminum.

.6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3

2.3 CONDUIT FASTENINGS

.1 One-hole malleable iron or steel straps to secure surface conduits 50 mm, NPS 2 and smaller.

.1 Two-hole steel straps for conduits larger than NPS 2, 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits as per manufacturers recommendations.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for NPS 1, 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Surface mount conduits except in public areas.

.4 Use rigid galvanized steel, aluminum, hot dipped galvanized steel, threaded conduit except where specified otherwise.

.5 Use epoxy coated conduit underground and in corrosive areas.

.6 Use electrical metallic tubing (EMT) except in cast concrete, above 2.4 m not subject to mechanical injury.

.7 Use rigid pvc conduit in corrosive areas and underground.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.10 Minimum conduit size for lighting and power circuits: 19 mm, NPS 3/4.

.11 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.12 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel.

.1 Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.

.13 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.14 Mechanically bend steel conduit over 19 mm diameter.

.15 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.16 Install fish cord in empty conduits.

.17 Run 2-NPS 1, 25 mm spare conduits up to ceiling space and 2-NPS 1, 25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface concrete type box.

.18 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.19 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits NPS 1, 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.8 CLEANING

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

END OF SECTION

1 General

1.1 RELATED WORK

.1 Excavating, Trenching and Backfilling: Division 02

.2 Concrete Form-Work Division 03

.3 Concrete Reinforcement: Division 03

.4 Cast-In-Place Concrete: Division 03

.5 Brick Masonry: Division 04

.6 Mortar and Grout for Masonry: Division 04

2 Products

2.1 PVC DUCTS

.1 PVC ducts, type EB1, encased in reinforced concrete where indicated.

2.2 PVC DUCT FITTINGS

.1 Rigid PVC couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

.2 Expansion joints.

.3 Rigid PVC 5° angle couplings.

2.3 MARKERS

.1 Concrete type cable markers: 100 x 600 x 100 mm, with words; "cable", "joint" or "conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

.1 Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

.2 Comply with ASTM C 858 for design and manufacturing processes.

.3 Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.

.1 Cover Hinges: Concealed, with hold-open ratchet assembly.

.2 Cover Handle: Recessed.

.1 Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

.2 Cover Legend: Molded lettering, "ELECTRIC."

.3 Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

.4 Duct Entrances in Handhole Walls: Provide end-bell or duct-terminating fitting in wall for each entering duct.

.1 Type and size shall match fittings to duct to be terminated.

.2 Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.

3 Execution

3.1 INSTALLATION

.1 Install underground duct banks including formwork.

.2 Build duct bank on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 98% or maximum proctor dry density.

.3 Prior to laying ducts, construct "mud slab" not less than 75 mm thick.

.4 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.

.5 Install base spacers at maximum intervals of 1.5 m leveled to grades indicated for bottom layer of ducts.

.6 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts. Stagger joints in adjacent layers at least 150 mm and make joints watertight. Encase duct bank with 75 mm thick concrete cover.

.7 Make transpositions, offsets and changes in direction using 5º bend sections. Do not exceed total of 20º with duct offset.

.8 Use bell ends at duct terminations.

.9 Use conduit to duct adapters when connecting to conduits.

.10 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.11 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material.

.12 Remove weights or wood braces before concrete has set and fill voids.

.13 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.14 Immediately after placing of concrete, pull through each duct a mandrel not less than 300 mm long and of a diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter.

.15 Avoid disturbing or damaging ducts where concrete has not set completely.

.16 Pull stiff bristle brush through each duct immediately before pulling-in cables.

.17 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

.18 Mark location of duct runs under hard surfaced areas with driven flush in edge of pavement, directly over run. Place concrete duct marker at ends of such duct runs. Construct markers and install flush with grade.

.19 Mark ducts every 150 m along straight runs and changes in direction.

.20 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.

.21 Provide drawings showing locations of markers.

3.2 INSPECTIONS

.1 Advise Consultant so that the installation may inspect ducts prior to placing and be present during placement of concrete and clean-out.

.2 Allow concrete to attain 50% of its specified strength before backfilling.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 22 Connectors and Terminations

.3 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

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

.3 Samples:

.1 Submit 1 sample of each component proposed for inclusion into system.

.2 Components will be returned for incorporation into work.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.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 Store materials in dry location, indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect photoelectric devices from nicks, scratches, and blemishes.

.3 Protect metal accessories and trim from being bent or damaged.

.4 Replace defective or damaged materials with new.

1.5 SUMMARY

.1 The following specification details the minimum compliance and related criteria for a complete and fully operational wired addressable lighting control system for all interior and exterior lights.

.2 Supply and install a lighting control system that meets all functional requirements noted, including all ancillary devices (relays, field modules, etc.) regardless of whether these ancillary devices are shown. Refer to these specifications (all sections) as well as drawings for overall lighting control requirements and functionality.

.3 Lighting control system shall utilize networking technology. The system shall be able to operate as a stand-alone entity.

.4 All components are to be supplied by the same manufacturer.

.5 The manufacturer shall start up and fully commission the lighting system with a final demonstration to the contract administrator and client representative. Programming time schedules to be obtained from client representative.

1.6 SUBMITTALS

.1 Submit under provisions of Section [01330.]

.2 Specification conformance document. Indicate whether the submitted equipment:

.1 Meets specification exactly as stated.

.2 Meets specification via an alternate means and indicates the specific methodology used.

.3 Shop drawings include:

.1 Load schedule indicating per circuit: actual connected load, load type, voltage, respective control zone(s), if on emergency, capacity, phase, and circuit number.

.2 Schematic of system.

.4 Product Data: Catalog specification sheets with performance specifications demonstrating compliance with specified requirements.

.5 Project Record Documents: Installer to record actual installation location and setting of area controller and components.

.6 Title 24 Acceptance Testing Documentation: Submit certification of acceptance in accordance with California Title 24 Part 6 when appropriate.

1.7 CLOSEOUT SUBMITTAL

.1 Sustainable design closeout documentation.

.2 Wired lighting control system manufacturer to provide an operation and maintenance manual that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.8 WARRANTY

.1 Provide manufacturer’s enhanced 5-year limited warranty.

.1 5-year limited warranty for the replacement of defective system components from the date of system shipment (except software application).

.2 Extended warranty options may be provided for an additional charge to extend the system warranty to a total of ten (10) years.

1.9 COMMISSIONING

.1 Provide factory-certified field service engineer to site to ensure proper system installation and that it is operating under the following parameters:

.1 Qualifications for factory-certified field service engineer:

.1 Certified by the equipment manufacturer on the system installed.

.2 Make a visit upon completion of installation of central lighting control system.

.1 Verify connection of power feeds and load circuit.

.2 Verify connection of wallstation controls.

.3 Verify proper connection.

.4 Download system data to controllers and devices.

.5 Check dimming panel load types and currents and remove bypass jumpers.

.6 Verify system operation control by control, circuit by circuit.

.7 Obtain sign-off on system functions.

.8 User to be trained on system operation.

.3 Conclude commissioning with:

.1 Verify system control operation area by area.

.2 Obtain sign-off on system functions.

.3 User to be trained on system operation.

.4 Optional follow-up visits to:

.1 Provide additional user training.

.2 Verify system continuous commissioning and control.

.3 Provide troubleshooting and/or suggestions for controls improvement.

2 Products

2.1 GENERAL

.1 Provide system hardware that is designed, tested, manufactured, and warrantied by a single manufacturer.

.2 Provide a low voltage control system designed to provide switching of exterior lighting loads by use of relays.

.3 All interior lighting control are standalone system.

.4 Standard of acceptance: Cooper Lighting Solutions ILC or approved equal.

2.2 RELAY PANELS

.1 Mechanical

.1 Meets UL, cUL, and/or CSA Standards specifically for the required loads. Provide evidence of compliance upon request.

.2 Delivered and installed as a factory assembled panel listed to UL508.

.3 Field wiring accessible from front of panel without need to remove dimmer or relay assembly or other components.

.2 Electrical

.1 Each programmable lighting controller shall be provided with a dual-rated, UL-listed Class 2 transformer capable of either 120/277 primary. It shall contain an internal self-resetting fuse.

.3 Performance

.1 Shall be UL listed to relevant standards (UL508A, UL916, cULus).

.2 Shall be capable of mixed voltages 120/347 VAC 50/60HZ.

.3 Shall be capable of mixed sources including normal and emergency power.

.4 Shall be capable of providing a mixed module solution panel including relays, dimmers, and manually addressable controls.

.5 Relay panels shall be available in sizes to accommodate relay outputs as required for design.

.6 Lighting relays to be capable of being single pole, double pole, and triple pole.

.7 The controller shall contain four ports for interfacing optional modules which include communications and power. Optional modules shall be able to be mixed on each controller.

.4 Relay Panel Emergency Bypass:

.1 Each lighting relay panel shall have the option to provide an emergency lighting bypass without the use of external devices, it shall be UL924 listed and clearly marked.

.1 If normal power is lost, if selected, the panel shall force the EM relays to the ON position. It shall also force any 0-10v dimming to 100%.

.2 It shall have the option to select the EM relay control for Force On, Force Off, and No Change.

.3 It shall monitor up to three phases of normal power. Upon loss of any phase, the panel will go into an emergency state. It shall be selectable for each phase monitored.

.4 It shall have barriers to sperate Normal and Emergency circuits.

.5 Relay Panel Programming:

.1 Programmable controllers shall be capable of being programmed, monitored, backed up, or controlled through any of the below methods.

.1 The system user shall be able to program, monitor, and control any of the controller features and functions using a local keypad and display. The interface shall consist of a 4-line 20-character backlit LCD display and 8 selection keys that change function based on the current operating mode.

.2 The system user shall be able to program, monitor, or control any of the controller features and functions using a Windows-based graphical user interface software using a USB port from a PC.

.3 The system user shall be able to remotely program, monitor, or control any of the controller features and functions using a Windows-based graphical user interface software using a PC with TCP/IP on a LAN or WAN.

.6 Single Pole, Double Pole, and Triple Pole Relay Performance:

.1 Shall be rated for the following:

.1 16A 120/277/347 VAC Electronic Ballast (LED).

.2 It shall be suitable for plug-loads.

.2 Lighting control relays shall be designed with latching mechanism that shall hold the relay in its last activated state indefinitely, with no change of state during an interruption of power. Solid-state or electrically held relays are not acceptable.

.3 Each lighting control shall contain an auxiliary set of contacts rated at 1 AMP 30 VAC/VDC electrically isolated but mechanically linked to the main contact for the purpose of true status monitoring and pilot light activation.

.4 Relays shall be equipped with an Enable/Disable switch to lock out On/Off control from the controller.

.5 Relays shall be equipped with manual actuator switch for turning the relay ON or OFF along with status indication.

.7 Dimming Module:

.1 Shall support up to four 0-10V channels.

.2 Shall be capable of controlling any 0-10V source.

.3 0-10V dimmers shall include a fail to full output safety feature by default.

.4 Shall include 100mA sink current per channel.

.8 Photoelectric Lighting Controls: to CSA C22.1.

.1 Wall mounting.

.2 Capable of switching 1800W of lighting at 120V.

.3 Voltage variation: plus, or minus 10%.

.4 Temperature range: minus 50 degrees C to plus 40 degrees C.

.5 Switching on lights at sundown.

.6 Switching off lights at sunrise

.7 Rated for 5000 operations.

.8 Options:

.1 Lightning arrester.

.2 Fail-safe circuit completed when relay de-energized.

.3 Twist-lock type receptacle.

.4 Terminal strip.

.5 Sensitivity adjustment.

.9 Switching time delay of 30s.

.10 Wall mounting bracket.

.11 Colour coded leads: size 10 AWG, 460 mm long.

.9 Networking:

.1 A USB, and TCP/IP port shall be provided for programming and interfacing the system with the use of personal computers.

3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with manufacturer's installation instructions.

.2 Provide complete installation of system in accordance with contract documents.

.3 Define each dimmer and relay's load type, assign each load to a zone, and set control functions.

.4 Provide equipment at locations and quantities indicated on drawings. Provide additional equipment as required to provide control intent.

.5 Devices to be connected via daisy chain topology.

.6 Network wire is CAT-5.

3.2 CLOSE OUT ACTIVITIES

.1 Training visit.

.2 Lighting control system manufacturer to provide one (1) additional on-site system training to site personnel.

.3 On-site walkthrough.

.4 Lighting control system manufacturer to provide a factory certified field service engineer to demonstrate system functionality.

END OF SECTION

1. General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

.1 Section Includes:

.1 Service and distribution switchboards rated 600 V and less.

.2 Surge protection devices.

.3 Disconnecting and overcurrent protective devices.

.4 Instrumentation.

.5 Control power.

.6 Accessory components and features.

.7 Identification.

.2 Related Requirements

.1 Section 26 06 06 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.

1.3 ACTION SUBMITTALS

.1 Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

.1 Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

.2 Shop Drawings: For each switchboard and related equipment.

.1 Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

.2 Detail enclosure types for types other than NEMA 250, Type 1.

.3 Detail bus configuration, current, and voltage ratings.

.4 Detail short-circuit current rating of switchboards and overcurrent protective devices.

.5 Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

.3 Coordination Curves

.1 Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

.2 Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

.1 Field Quality-Control Reports:

.1 Test procedures used.

.2 Test results that comply with requirements.

.3 Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

.1 In addition to items specified in Section 01 78 00 "Operation and Maintenance Data," include the following:

.1 Routine maintenance requirements for switchboards and all installed components.

.2 Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

.3 Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

.1 Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.

.2 Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

.3 Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.7 QUALITY ASSURANCE

.1 Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by CSA C22.1:21E.

.1 Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

1.9 FIELD CONDITIONS

.1 Environmental Limitations:

.1 Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete.

1.10 COORDINATION

.1 Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

.2 Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

.1 Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

2. Products

2.1 SWITCHBOARDS

.1 Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in CSA C22.1, by a qualified testing agency, and marked for intended location and application.

.3 Coordinate type of switchboard with types of overcurrent protective devices and with switchboard arrangement.

.4 Front-Connected, Front-Accessible Switchboards:

.1 Main Devices: Fixed, individually mounted.

.2 Branch Devices: Panel mounted.

.3 Sections front and rear aligned.

.5 Nominal System Voltage: 208Y/120 V.

.6 Main-Bus Continuous: ampere rating as per the single line diagrams.

.7 Indoor Enclosures: Steel, Sprinkler proof.

.8 Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's NAL 3001 finish over a rust-inhibiting primer on treated metal surface.

.9 Buses and Connections: Three phase, four wire unless otherwise indicated.

.1 Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.

.2 Copper feeder circuit-breaker line connections.

.3 Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.

.4 Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

.10 Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

.1 Molded-Case Circuit Breaker (MCCB) with fully rated interrupting capacity to meet available fault currents. Series ratings not accepted.

.1 Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

.2 Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

.3 Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

.1 Instantaneous trip.

.2 Long- and short-time pickup levels.

.3 Long and short time adjustments.

.4 Ground-fault pickup level, time delay, and I squared t response.

.2 Provide a lock feature for the switch so that it may be locked in either the off or on maintenance-mode position.

.3 Provide a blue LED indicating light to indicate that the switch is in maintenance mode.

.4 Provide dry relay contacts on each switch for annunciation of the switch position.

3. Execution

3.1 EXAMINATION

.1 Receive, inspect, handle, and store switchboards.

.1 Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.

.2 Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.

.3 Protect from moisture, dust, dirt, and debris during storage and installation.

.4 Install temporary heating during storage per manufacturer's instructions.

.2 Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

.3 Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

.4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Equipment Mounting: Install switchboards on concrete base, 100-mm nominal thickness.

.1 Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 50mm above concrete base after switchboard is anchored in place.

.2 Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

.3 Install anchor bolts to elevations required for proper attachment to switchboards.

.2 Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

.3 Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

.4 Install filler plates in unused spaces of panel-mounted sections.

.5 Install overcurrent protective devices, surge protection devices, and instrumentation.

3.3 CONNECTIONS

.1 Coordinate this article with Drawings. Show locations and types of grounding connections available and which ones are used for grounding switchboards.

.2 Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per CSA C22.1

.3 Support and secure conductors within the switchboard according to CSA C22.1

3.4 IDENTIFICATION

.1 Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 00.

.2 Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 00.

.3 Device Nameplates: Label each disconnecting, and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 00.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

.2 Perform tests and inspections with the assistance of a factory-authorized service representative.

3.6 ADJUSTING

.1 Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

.2 Set field-adjustable circuit-breaker trip ranges as specified in Section 26 06 06.

3.7 DEMONSTRATION

.1 Select last option in paragraph below if retaining items in "Disconnecting and Overcurrent Protective Devices" Article above.

.2 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION

1. General

1.1 RELATED WORK

.1 Rough Carpentry - Plywood Backboard: Division 06

.2 Electrical Digital Metering Section 26 27 13

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

2. Products

2.1 PANELBOARDS

.1 Panelboards: product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 208V branch circuit panelboards: bus and breakers rated for (symmetrical) interrupting capacity or as indicated on drawings.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Side wireways to accommodate local metering instruments where required.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Weather proof enclosure for exterior mounted panels where required.

.11 Finish: RAL factory applied colour in accordance with voltage rating.

.12 Incorporate TVSS into all 120 / 208V branch circuit panels where shown.

2.2 BREAKERS

.1 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.2 Lock-on devices for 10% of breakers installed as indicated. Turn over unused lock-on devices to Owner.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4 METERS

.1 Branch circuit in panelboard and panelboards are to be provided with an integral electronic sub meter where shown on the single line diagram and panel schedule. Refer to specification section 26 27 13 for additional performance requirements.

2.5 ACCEPTABLE PRODUCTS

.1 Eaton

.2 Schnieder

.3 Siemens

.4 ABB

3. Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group on common backboard.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1 General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and Division 26 Specification Sections, apply to this Section.

1.2 REFERENCES

.1 General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

.1 American National Standards Institute (ANSI)

.1 ANSI C12.20, "Electricity Meters - 0.2 and 0.5 Accuracy Classes."

.2 ANSI C12.18, "Protocol Specification for ANSI Type 2 Optical Port."

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No. 61010-1 “Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements”

.2 C22.1, “Canadian Electrical Code, Part I” (CEC)

.2 International Organization for Standardization (ISO)

.1 ISO 9001, “Quality Management Systems - Requirements”

.2 ISO 14001, “Environmental Management Systems - Requirements with Guidance for Use”

.3 ISO 14062, “Environmental Management - Integrating Environmental Aspects into Product Design and Development”

.4 ISO 50001:2011 “Energy management systems”

1.3 SUBMITTALS

.1 General: Submittals shall be in accordance with the requirements of the Submittals Section in Division 1 and the Division 26, in addition to those specified herein.

.2 Submit enough information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.

.1 Attach copies of approved Product Data submittals for products that describe the following:

.1 Location of the meters and gateways, and routing of the connecting wiring.

.2 Details of power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: For power monitoring and control units to include in operation and maintenance manuals.

1.5 COORDINATION

.1 Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.

.2 Match components and interconnections for optimum performance of specified functions.

.3 Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

2 Products

2.1 GENERAL REQUIREMENTS

.1 Products specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements.

.2 Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date:

.1 Square D Power Logic by Schneider Electric

.2 EATON Corporation Power Xpert Metering System

.3 Siemens Canada Ltd PAC Intelligent Metering

.4 CARMA Metering Solutions

.1 EMP + – Electrical,

.2 ACUREVE 2000 Series,

.3 Profiler – Gas and Water. To be coordinated with Mechanical.

2.2 SYSTEM DESCRIPTION

.1 Microprocessor-based, multichannel monitoring and control of electrical power distribution system(s) that includes the following:

.1 Integral to incoming MDP utility service and distribution feeders, digital sub-metering on secondary CDPs, Panels and branch breakers as noted on drawings.

.2 Electrical meters that monitor, control, and connect to the data transmission network.

.3 LAN: High-speed, multi-access, open, non-proprietary, industry-standard communication protocols.

.2 The electrical power monitoring and control system shall be connected to the Building Automation System for monitoring and logging.

.3 System software shall be based on server thin-client architecture, designed around open standards of internet technology.

.4 Intent of thin-client architecture is to provide operators complete access to power monitoring and control system via an Internet browser. No special software other than an Internet browser shall be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.

.5 Internet access shall be password protected.

2.3 PERFORMANCE REQUIREMENTS

.1 Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.

.2 Addressable Devices: All transmitters and receivers shall communicate unique device identification and status reports to monitoring and control clients.

.3 Interface with BMS System: Provide factory-installed hardware and software to enable the BMS system to monitor, display, and record data for use in processing reports.

.1 Hardwired Monitoring Points: Electrical power demand (kilowatts), electrical power consumption (kilowatt-hours).

.4 Backup Power Source:

.1 Electrical power distribution equipment served by a backup power source for controls shall have associated power monitoring and control system products that monitor and control such systems and equipment also served from a backup power source.

2.4 ADVANCED POWER QUALITY METERS

.1 The digital metering device intended to monitor the mains as well as critical feeders for network management, energy cost allocation, power quality analysis, asset management, operational efficiency, and compliance reporting, shall have at minimum, the following capabilities:

.1 The voltage inputs of the meter shall provide a minimum of 4 phases, neutral and ground inputs. The meter shall support direct connection of low voltage circuits up to 600V (UL) without need for voltage (potential) transformers. The meter shall support connection of medium and high voltage circuits through voltage (potential) transformers and provide user definable primary and secondary transformer ratios.

.2 The current inputs of the meter shall provide a minimum of 5 inputs and support nominal input currents of both 5A and 1A.

.3 The digital meter shall support measured and calculated metering parameters including four-quadrant metering, full range of 3-phase voltage, current, power and energy measurements, % unbalance, power factor (true & displacement – per phase and three-phase) demand (min/max, present demand interval, running average demand, and predicted demand), total harmonic distortion (THD), individual current and voltage harmonics readings.

.4 The meter shall meet stringent IEC and ANSI measurement accuracy standards including ANSI C12.20 accuracy class 0.1, current class 2, 10 and 20.

.5 The meter shall have a high-visibility color graphical display that is user programmable to display up to 20 parameters per screen. The meter shall be capable of displaying graphical metering data including at minimum spectral components, phasor diagrams, and trending charts. The meter shall be capable of displaying harmonics content (THD, K-factor, crest-factor) in histogram format. The meter shall be provided with a graphical color display.

.6 The meter shall provide integrated I/O with at least 8 digital inputs, 2 digital outputs, and 2 relay outputs for equipment status/position monitoring and equipment control/interface. The digital (pulse) output operation shall provide kWh / kVARh total/imported/exported energy consumption.

.7 The meter shall accept and be provided with 2 each type of field installable I/O modules. Each digital I/O module shall provide digital status/counter inputs and Form C relay outputs. Each analog I/O module shall provide inputs configurable to 4-20 mA or 0-30V ranges and outputs configurable to 4-20 mA or 0-10V ranges.

.8 The meter shall provide multi-port Ethernet and serial communications with Ethernet ports and RS485 serial ports. The Ethernet ports shall support offer E-mail on alarm, E-mail interval energy data, customizable web server. The meter shall provide an Ethernet-to-serial RS-485 gateway function. Communication protocols supported by the meter shall include Modbus, TCP/IP or BACnet as required by the City of Lloydminster.

.9 The meter shall comply with cybersecurity requirements and have the ability to independently enable or disable communication ports

.10 The meter shall be capable of self-identification on an Ethernet network without any device configuration or user interaction.

.11 The on-board logging capability of the meter shall have non-volatile time stamps with on-board logging of I/O conditions, min/max values, energy and demand, maintenance data, alarms, and any measured parameters; trending and short-term forecasting of energy and demand. The meter shall have the ability to record any parameter in the meter, and trigger multiple such recordings in continuous succession. The meter shall support user defined recording intervals.

.12 The meter's on-board web server shall provide access to real-time values, power quality information, and basic meter configuration. The waveform viewing capability shall provide the ability to visualize all voltage and current phases of captured waveforms concurrently using a standard web browser; allows waveform selection, voltage and current phase selection, zooming in and out, panning with select zoom, saving and printing. The web interface shall be fully customizable with support for user defined web views.

.13 The meter shall provide set-point driven alarming capability. The meter shall be able to generate an E-mail notification on an alarm condition. Alarm entries shall have millisecond resolution timestamps.

.14 The meter shall provide a time-stamped event log.

.15 The meter shall provide the following capabilities without separate software: Display statistical indicators of power quality on the front display; Provide statistical indicators of power quality that include, but are not limited to, voltage dips and swells, harmonics, frequency, rapid voltage change and mains signaling. The meter shall simultaneously capture voltage and current channels for sub-cycle disturbance, transients, as well as multi-cycle sags, swells and outages in quick succession, without dead time between recordings. The meter shall provide the ability to record prior to fault. The meter shall have the ability to record for voltage, current, frequency, power, power factor and unbalance, based on a power system event, and record of RMS values prior to the event trigger.

.16 The meter shall provide high-speed sag/swell detection of voltage disturbances on a cycle-by-cycle basis, providing duration of the disturbance, the minimum, maximum, and average value of the voltage for each phase during the disturbance. The meter shall detect disturbances less than one cycle in duration. The meter shall have the ability to determine the location of a disturbance more quickly and accurately by identifying the direction of the disturbance relative to the meter. The disturbance direction shall be captured in the device's event log, along with a timestamp and confidence level indicating level of certainty.

.17 The meter shall provide a graphical flexible programming capability with programmable modules that access metered and input data. The meter shall be capable of deriving values and combinations of measured or calculated parameters, using arithmetic, trigonometric, logic, thermocouple linearization and temperature conversion functions. The meter shall have programming modules that can be arbitrarily linked together to create application functionality such as totalizations, efficiency measurements, load aggregation, control functions, load shedding, demand response, power factor correction, and compliance monitoring. The meter shall have the ability to read data from networked Modbus devices for the purposes of logging, exporting, aggregation, totalization, display visualization, web visualization or other user defined functions.

2.5 BASIC METERS

.1 The digital metering device intended to monitor the electrical panel loads for energy monitoring and management application.

.1 Power meters shall be compliant with ANSI C12.20, Active energy accuracy standards.

.2 All setup parameters required by the power meter shall be stored in non-volatile memory and retained in the event of a control power interruption.

.3 The power meter may be applied in single phase, three-phase, three- or four-wire systems in WYE or Delta mode.

.4 The power meter shall be capable of being applied without modification at nominal frequencies

.5 The power meter shall have a real-time clock with battery back-up with at least 1-year ride-through time without external power.

.6 The power meter unit shall have removable connectors for voltage inputs, control power, communications, input and outputs.

.7 The power meter unit shall be easily mounted in the pre-made cut-out without tools.

.8 The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 31st harmonic (fundamental of 50/ 60 Hz). The power meter shall provide continuous sampling at a minimum of up to 64 samples/cycle, simultaneously on all voltage and current channels in the meter.

.9 The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 63rd harmonic (fundamental of 60 Hz). The circuit

monitor shall provide continuous sampling at a minimum of up to 128 samples/cycle, simultaneously on all voltage and current channels in the meter

.10 The power meter shall support digital inputs for demand interval synch pulse, time synch input, conditional energy control, and mechanical relay outputs.

.11 The power meter shall support digital inputs for demand interval synch pulse, time synch input, conditional energy control, and solid state outputs

.12 The power meter shall allow the user to pre-set the energy quantity at any value within the register range via communications, to match a unit being replaced in the field.

.13 The power meter shall provide the user the ability to reset the cumulative energy quantities from the display of the unit or via communications.

.14 The power meter shall provide for onboard data logging. Each power meter shall be able to log data, alarms and events, and waveforms (if applicable). Logged information to be stored in each power meter include the following: data logs, min/max log files of selected parameter values, alarm logs for each user-defined alarm or event and waveform log. The meters shall offer the following on-board non-volatile memory

.15 The power meter shall have alarm events user-definable. Setpoint-driven alarm events shall be available for voltage/current parameters, input status, and end of interval status. For each over/under metered value alarm, the user shall be able to define a pick-up, drop-out, and delay.

.16 Historical alarms shall have a time-stamping with 1-second accuracy. The meter's real-time clock shall be able to synchronize using communications command.

.17 Indication of an alarm condition shall be given on the front panel.

.18 Communication protocols supported by the meter shall include BACnet, Modbus, TCP/IP.

.19 The power meter display shall be backlit dot-matrix LCD for easy viewing. Display shall also be anti-glare and scratch resistant.

.20 Measured values

.1 The power meters shall provide the following, true RMS metered quantities. In addition, the power meters shall record and save in non-volatile memory the minimum and maximum values of all listed values since last reset. The power meters shall also record and save in non-volatile memory the interval minimum, maximum, and average of any of the values pre-defined over a user specified interval.

.2 Real-time readings

.1 Current (per-phase, 3-phase avg, % unbalanced)

.2 Neutral and ground (4 CTs)

.3 Voltage (L–L per-phase, L-L 3-phase avg, L–N per-phase, 3-phase avg, % unbalanced)

.4 Real power (per-phase, 3-phase total)

.5 Reactive power (per-phase, 3-phase total)

.6 Apparent power (per-phase, 3-phase total)

.7 Power factor (true/displacement) (per-phase, 3-phase total)

.8 Frequency

.9 THD, thd, TDD (current and voltage), neutral & ground current THD

.10 Individual harmonics up to the order of 15th, 31st in & 63rd

.11 Temperature (internal ambient)

.12 K-factor (per-phase)

.13 Crest factor (per-phase)

.3 Energy readings

.1 Accumulated energy (real kWh, reactive kVARh, apparent kVAh) (signed/absolute)

.2 Active energy delivered

.3 Reactive energy delivered

.4 Demand readings

.1 Demand current calculations (per-phase, 3-phase avg, neutral)-present and peak

.5 Demand calculations (3-phase total)

.1 Real power

.2 Reactive power

.3 Apparent power

.6 Power demand calculation methods

.1 All power demand calculations shall use any one of the following calculation methods, selectable by the user:

.2 Block interval, with optional sub-intervals. Block methods available are sliding, fixed and rolling.

.3 Demand can be calculated using a synchronization signal:

.4 Demand can be synchronized to an input pulse from an external source.

.5 Demand can be synchronized to a communication signal.

.6 Demand can be synchronized to the clock in the power meter

.7 Power analysis values

.1 THD, thd – voltage, current (3-phase, per-phase, neutral & ground current)

.2 Power factor (per-phase, 3-phase)

.3 Displacement power factor (per-phase, 3-phase)

.4 Fundamental voltage, magnitude and angle (per-phase)

.5 Fundamental currents, magnitude and angle (per-phase)

.6 Fundamental real power (per-phase, 3-phase)

.7 Fundamental reactive power (per-phase)

.8 Harmonic power (per-phase, 3-phase)

.9 Phase rotation

.10 Unbalance (current and voltage)

.11 Harmonic magnitudes & angles (per-phase)

.12 Total demand distortion factor (TDD)

3 Execution

3.1 INSTALLATION

.1 In addition to the requirements specified herein, execution shall be in accordance with the requirements of other Division 26 Sections and Drawings.

.2 Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

.3 Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting performance of the Work.

.4 Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

.5 Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

.6 Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.

.7 Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory trained manufacturer's representative field service engineer. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment. Report to the Engineer any discrepancies or issues with the installation.

.8 Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CAN/CSA C22.2, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2, Rigid Metal Conduit.

.3 CSA C22.2, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2, Electrical Metallic Tubing.

.5 CSA C22.2, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2, Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.5 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 Store materials indoors, off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SWITCHES

.1 20, 15A, 120 V, single pole, double pole, three-way, four-way switches to: CSA C22.2.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.3 Toggle operated, locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Provide Twisted lock outlets for all receptacles mounted on the existing cable tray in the data room.

2.3 SPECIAL WIRING DEVICES

.1 None.

2.4 WIRING DEVICES FOR LAN ROOMS

.1 Twisted lock receptacles or special receptacle in Lan Room to be coordinated for exact location and required on site prior to rough-in as shown on drawings.

2.5 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Plastic white cover plates, thickness 2.5 mm.

.4 Cast, Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.6 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00- Common Work Results for Electrical and as noted on electrical drawings for the data room outlets.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00- Common Work Results for Electrical and as noted on electrical drawings for the data room outlets.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with site conditions.

.1 Leave Work area clean at end of each day.

3.3 PROTECTION

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

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

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

.3 Include time-current characteristic curves for breakers and with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Representative and Consultant for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant and Representative. Unless complying with this requirement, Consultant and Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title: _____

.2 End user's reference number: _____

.3 List of circuit breakers: _____

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00- Common Product Requirements.

.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 Store circuit breakers in dry location, off ground, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse by manufacturer and return of pallets, padding, packaging materials, crates as specified in Construction Waste Management in accordance with Section 01 74 19- Waste Management and Disposal.

2 Products

2.1 BREAKERS GENERAL

.1 Circuit breakers, accessory high-fault protectors Moulded-case circuit breakers, fused circuit breakers, ground-fault circuit-interrupters, : to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.6 Circuit breakers with interchangeable trips as indicated.

2.2 THERMAL MAGNETIC BREAKERS<ACTION>DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS (DESIGN B)

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS (DESIGN C)

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS (DESIGN D)

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and short time tripping for ground and phase fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism [c/w time delay unit] .

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

2.7 ENCLOSURE

.1 As per manufacturers specifications.

3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials for recycling, reuse in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 SCOPE

.1 Furnish and install the low voltage manual transfer switches having the ratings, features/accessories and enclosures as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

1.3 REFERENCES

.1 The transfer switch shall be designed, manufactured and tested in accordance with the following latest applicable standards:

.1 UL 1008: Standard for Safety - Transfer Switch Equipment

.2 CSA C22.2 No. 178: Automatic Transfer Switches

.3 UL 991: Standard for Tests for Safety-Related Controls Employing Solid-State Devices

.4 NFPA 70: National Electrical Code

.5 NFPA 99: Essential Electrical Systems of Health Care Facilities

.6 NFPA 110: Emergency and Standby Power Systems

.7 NEMA ICS 10: Electromechanical AC Transfer Switch Equipment

.8 IEEE 446: Recommended Practice for Emergency and Standby Power Systems

1.4 SUBMITTALS FOR - REVIEW/APPROVAL

.1 The following information shall be submitted to the Engineer:

.1 Front view and plan view of the assembly

.2 Schematic diagram

.3 Conduit space locations within the assembly.

.4 Assembly ratings including:

.1 Voltage rating

.2 Continuous current rating

.3 Withstand and closing current ratings

.5 Cable terminal sizes

.6 Product Data Sheets.

.2 Where applicable, the following additional information shall be submitted to the Engineer:

.1 Busway connection

.2 Connection details between close-coupled assemblies

.3 Composite front view and plan view of close-coupled assemblies

1.5 SUBMITTALS FOR - CONSTRUCTION

.1 The following information shall be submitted for record purposes:

.1 Final as-built drawings and information for items listed in section 1.04 and shall incorporate all changes made during the manufacturing process.

.2 Wiring diagrams

.3 Certified production test reports

.4 Installation information

.5 Seismic certification as specified.

1.6 QUALIFICATIONS

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 REGULATORY REQUIREMENTS

.1 Provide a certificate of compliance with UL 1008 for the transfer switches furnished under this section.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

.2 Equipment being stored prior to installation shall be maintained in a clean and dry condition. If stored outdoors, indoor equipment shall be covered and heated, and outdoor equipment shall be heated.

1.9 FIELD MEASUREMENTS

1.10 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

2 Products

2.1 MANUFACTURERS

.1 Eaton

.2 Schneider Electric

.3 ABB

.4 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the

specification and manufactured by others not named will be considered only if pre-approved by the engineer ten (10) days prior to bid date.

2.2 RATINGS

.1 Voltage and amperage ratings shall be as indicated on the drawings.

2.3 CONSTRUCTION

.1 Transfer switches shall be UL 1008 listed for application in their intended enclosures at 100% of continuous ampere rating and shall meet or exceed UL 1008 endurance test criteria to include rate of operation and number of operation cycles.

.1 The transfer switch shall be designed and intended for switching the load connection between two power sources.

.2 The transfer switch shall include mechanical interlocks to prevent unintentional paralleling of the power sources.

.3 The transfer switch shall be of double throw construction and include molded case switches and/or circuit breakers in a fixed mount configuration, Eaton series or approved equal, with high-endurance characteristics capable of no-load and full-load interruptions at rated current equal to or exceeding UL 1008 endurance ratings.

.4 Molded case switches/circuit breakers shall include a fixed instantaneous override trip element providing protection against high fault currents.

.5 Molded case switches/circuit breakers shall be encased in a rigid housing constructed of durable high-strength insulating material with excellent dielectric characteristics capable of withstanding high-dynamic and thermal stresses. The molded case switch/circuit breaker interrupt current rating shall equal or exceed the transfer switch short-circuit withstand closing current rating.

.6 Molded case switches/circuit breakers shall include arc extinguishers that confine, divide and extinguish an arc that may develop between the main contacts.

.7 The transfer switch shall include a reliable mechanical operator mechanism that is capable of opening and closing the main contacts.

.8 Front access to all molded case switch/circuit breaker connection points shall be provided for ease of troubleshooting.

.9 The transfer switch main contacts shall be of silver composition, manually operated and mechanically held in position.

.10 A removeable, steel dead-front panel shall be mounted in front of each molded case switch/circuit breaker providing a physical barrier when the front door is open.

.11 The transfer switch shall include a permanently affixed handle for manually initiating and operating a load transfer between the power sources under full-rated load conditions.

.12 The transfer switch shall provide colored, mechanical indication of source 1 and source 2 main contact position (open/closed).

.13 A copper ground bus shall be furnished firmly secured to the enclosure structure.

.14 Control wire bundles shall be secured to the assembly with nylon ties, pre-punched lances or anchors. All current transformer secondary leads shall first be connected to shorting terminal blocks with shorting screws. Control wire shall be marked with an origin and destination over the entire length of the wire using a cured ink process to the maximum extent possible. Where ink marking is not possible, printed sleeve wire markers at each end of control wire shall be provided.

.15 Mechanical type lugs shall be provided for all source 1, source 2, and load terminations suitable for copper or aluminum cable.

.2 Transfer switches shall be open transition (break-before-make) and permit the manual operator to pause in the load disconnect ("neutral") position.

.3 Transfer switches requiring a switched neutral shall include a fully rated fourth pole that is identical to the other power poles. Switched neutral poles which are add-on, overlap, or not capable of breaking full rated load current are not acceptable.

.4 Transfer switches requiring a solid neutral shall include a fully rated, solid neutral plate.

.5 Transfer switches shall be capable of being operated manually under full-rated load conditions. Manual operation shall be accomplished by use of a permanently affixed handle. Removable handles are not acceptable. Manual operators requiring power source disconnection or de-energization prior to manual operation are not acceptable.

.6 Transfer switches intended for use as service equipment shall meet the following:

.1 UL1008 listed as a complete assembly to include the transfer switch, service disconnect, and overcurrent protection device(s). UL1008 listed transfer switches with a separately attached compartment or enclosure, for housing the service disconnect and/or overcurrent protection device(s), that has not passed UL 1008 temperature rise testing and is UL 891 listed only will not be accepted.

.2 UL1008 listed and marked "continuous load current not to exceed 100 percent of switch rating". Transfer switches marked as 80 percent will not be accepted.

.3 Provide a ground bus, neutral disconnect link, and neutral-to-ground bonding jumper as required for service entrance equipment.

.4 Provide ground fault protection for use with solidly grounded wye electric services of more than 150 volts to ground where the service disconnect rating is 1000A or more.

2.4 ENCLOSURE

.1 Each transfer switch shall be provided in a NEMA enclosure suitable for use in environments indicated by the drawings.

.2 NEMA 1, 12, and 3R steel enclosures shall include a light gray ANSI 61 finish.

.3 NEMA 4X enclosures shall be constructed of 316 stainless-steel with a mill finish.

.4 The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and mounted using the anchor points shown on the as-built drawings.

.5 Surge protection device: Provide a 50KA surge protection device as indicated on the drawings

2.5 WITHSTAND AND CLOSING CURRENT RATINGS

.1 Short-circuit

.1 The transfer switch shall be UL1008 listed and rated for use in a circuit capable of delivering the short-circuit current shown on the drawings.

.2 The transfer switch shall have a short-circuit withstand and closing current rating of 65KA at 208 volts.

TABLE 1: UL 1008 Listed Short-Circuit Withstand Closing Current Ratings (kA)							
Transfer switch ampere rating	Frame	Up to 240 Vac		Up to 480 Vac		Up to 600 Vac	
		Switch[1]	Breaker[2]	Switch[1]	Breaker[2]	Switch[1]	Breaker[2]
40-200	P2	100	200	65	100	25	35/25
225-400	P3	100	200	65	100	35	65
600	P4	100	100	65	65	35	35
800-1000	P5	100	200	65	65	35	65

3 Execution

3.1 EXAMINATION

3.2 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 UL and NEMA standards.

.1 Insulation check to ensure the integrity of insulation and continuity of the entire system

.2 Visual inspection to ensure that the switch matches the specification requirements and to verify that the fit and finish meet quality standards.

.3 Mechanical tests to verify that the switch's power sections are free of mechanical hindrances.

.4 Electrical tests to verify the complete electrical operation of the switch and to set up time delays and voltage sensing settings of the logic.

.2 The manufacturer shall provide a certified copy of factory test reports.

.3 Transfer switch shall include a label indicating order number, catalog number and date.

3.3 INSTALLATION

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

.2 All necessary hardware to secure the assembly in place shall be provided by the contractor.

3.4 MANUFACTURER'S CERTIFICATION

.1 A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

.2 The Contractor shall provide a copy of the manufacturer's representative's certification.

3.5 TRAINING

.1 The Contractor and Manufacturer's qualified representative shall conduct a training session for up to five (5) owner's representatives for 2 normal workdays at a jobsite location determined by the owner. The training program shall consist of the instruction on the operation of the transfer switch and the major components within the assembly.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical

.2 Section 26 05 20 – Wire and Box Connectors (0-1000V)

.3 Section 26 05 34 – Conduits, Conduit Fastening and Conduit Fittings

1.2 SYSTEM DESCRIPTION

.1 A transient voltage surge suppressor for the protection of downstream electronic equipment connected to the building power supply. The specified unit shall be compatible with non-linear loads and shall provide effective high-energy transient voltage suppression, surge current diversion and high-frequency electrical noise filtering while connected in parallel with a facility's distribution system. The filtering unit shall utilize non-linear voltage dependent metal oxide varistors or selenium cells. The suppression system's components shall not utilize gas tubes, spark gaps, or silicon avalanche diodes. The device shall be referred to as a TVSS filter for the purpose of this document and drawings.

2 Products

2.1 OPERATION AND ENVIRONMENT

.1 Voltage: The TVSS devices shall be suitable for the voltage and systems configuration.

.2 Maximum Continuous Operating Voltage (MCOV): The maximum continuous operating voltage of the suppressor unit shall be greater than 125% for 120/208 V systems.

.3 Protection Modes: Transient voltage surge suppression (TVSS) paths shall be provided for all possible common and normal modes (between each line and ground, neutral and ground, line to line and each line and neutral). The primary suppression path shall not be to ground.

Peak surge Current per Phase	240,000 Amps	(Main entrance panel applications)
	120,000 Amps	(Branch Panel Applications)
	30,000 Amps	(Plug-in / Cord -- connected individual equipment protection)
Let Through Voltage (L-N)	120 V (individual equipment units)	330 V
	208 V Units	500 V
TVSS clamping components response time	$<$ 1 nanosecond	

.4 Filtering

.1 TVSS shall contain a high frequency extended range tracking filter.

.2 Noise attenuation $\geq$45 dB @ 1`00 kHz.

.3 Branch panel application effective filtering bandwidth - 1 kHz to 50 Mhz. Plug-in/Cord - Connected Individual Equipment application effective filtering bandwidth - 100 kHz to 100 Mhz.

2.2 SURGE PROTECTION DEVICES SERVICE ENTRANCE

.1 Type 1, Complying with UL 1449, 3rd edition, with UL card.

.2 SPD relying upon external or supplementary installed safety overcurrent protection do not meet the intent of this specification.

.3 Arranged for copper bus bar connections to phase buses, neutral bus, and ground bus.

.4 A three pole circuit breaker for dedicated disconnecting means shall be provided in the switchgear.

.5 LED indicator lights for power and protection status.

.6 Audible alarm, with silencing switch, to indicate when protection has failed.

.7 Form-C contacts rated at 5 Amp and 250-VAC, one normally open and one normally closed. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.

.8 Six-digit transient-event counter set to totalize transient surges.

2.3 PANELBOARD COMPONENT (INTEGRATED TVSS PANEL)

.1 Main Bus: The device shall have a copper.

.2 Circuit Breakers: Are to be of the over center toggle mechanism type which use bolt-on connectors to line side panelboard connectors.

.3 Neutral Bus: The unit shall be equipped with a copper 200% rated neutral bus suitable for use with non-linear loads, which shall include a sufficient quantity at solderless type lugs to service the total unit circuit capacity.

2.4 GENERAL FEATURES

.1 Connectors: Terminals shall be provided for all the necessary input and output power and ground connections on the TVSS.

.2 Enclosure: The specified system shall be provided in a heavy duty NEMA 12 dust tight enclosure with no ventilation openings for maintenance and branch panel applications. Indication of surge current module status shall be visible without opening the door.

.3 Internal Connections: All surge current diversion connections shall be by way of low impedance wiring. Surge current diversion components shall be wired for reliable low impedance connections. No plug-in component modules, quick disconnect terminals or printed circuit boards shall be used in surge suppression paths.

.4 Unit Status Indicators: Red status indicators shall be provided on the hinged front cover to indicate unit phase status. The absence of the red light shall reliably indicate that one or more surge current diversion phases have failed and that service is needed to restore full operation.

.5 Fuses: The unit shall utilize internal fuses rated with a minimum interrupting capability of 2000,000 A or greater.

.6 Identification: The unit shall include manufacturer’s nameplate, UL rating, and a CSA approval on the exterior enclosure.

.7 Warranty: The manufacturer shall provide a five-year warranty on the TVSS filter, a one-year warranty on the panelboard and circuit breakers, and a one-year warranty on

individual equipment plug-in units. These warranties shall commence from date of shipment.

.8 Testing: Testing at each unit shall include assurance checks, “Hi-Pot” test at two times rated voltage plus 1000 volts per UL requirements, and operation and calibration tests.

.9 Approved Manufacturers: SurgePure, Current Technologies, Liebert Corporation, Tycor International.

3 Execution

3.1 INSTALLATION

.1 Install with manufacturer’s recommended conductors tapped from the electrical service switchboard conductor system. Conductors are to be as short and straight as possible. Input conductors to the TVSS shall be twisted together to reduce impedance during high frequency filtering.

.2 An appropriately sized manual safety disconnect shall be installed before and in line with the TVSS from the electrical service for the purpose of electrically isolating the device from the system should service be required without interrupting the main service. Coordinate required disconnect ampacity with TVSS manufacturer.

.3 The TVSS should be following the manufacturer’s recommended practices as outlined in the manufacturer’s installation and Maintenance Manual and in compliance with all applicable electrical codes.

.4 Individual equipment protection devices shall be installed at the same voltage rating as the intended protected equipment and as close as possible to the intended protected equipment.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.2 CSA Group (CSA)

.3 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by consultant.

.3 Photometric data to include: VCP Table where applicable and spacing criterion.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00- Quality Control.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00- Quality Control.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, packaging materials and padding in accordance with Section 01 74 19- Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

2 Products

2.1 LAMPS

.1 All light fixtures shall have an LED source.

2.2 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.3 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.4 LUMINAIRES

.1 Type 100 – Finelite – HPT-2'x2'-120V-80CRI-4000K.

.2 Type 101 – Metalux – SNX Lensed-4'-120V-SLW-80CRI-4000K.

.3 Type 102 – Metalux – SNX Lensed-4'-120V-LW-80CRI-4000K.

.4 Type 104 – Halo-HC6-1500lm-120V-80CRI-4000K.

.5 Type 105 – AIMLITE – VWP4-L Gen2-4' LED Vapor Tight-80CRI-4000K.

.6 Type 200 – LUMARK – AXCENT – WALL Mounted.

.7 Type 201a/b – LUMARK – PREVAIL – Wall mounted.

.8 Type 202a – LUMARK – PREVAIL – Pole mounted complete with pole.

3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

.2 All wiring, conduits and terminations in the wash bays shall be seal tight and shall be water proof.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11- Cleaning.

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

.2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA C22.1-21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.1 Indicate on drawings:

.1 Battery charge and discharge voltage/time characteristics.

.4 Test Reports:

.1 Submit field test record.

.5 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for central emergency system for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.

.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 Store materials in dry location, indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect central emergency system from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21- LEED Requirements.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of crates, pallets, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19- Waste Management and Disposal.

2 Products

2.1 SYSTEM DESCRIPTION

.1 Central system rated at 120V with installed battery capacity of 1000W and to produce not less than 91% of nominal DC system voltage with AC supply off 90 minutes.

2.2 EQUIPMENT MOUNTING

.1 Enclosed system:

.1 Painted in accordance with Section 26 05 00- Common Work Results for Electrical.

2.3 STANDARD ACCEPTANCE MANUFACTURERS

.1 AimLite – Wall Mounted Mini Inverter

.2 ABB – Wall Mounted Mini Inverter Series

.3 Approved Equal

3 Execution

3.1 INSTALLATION

.1 Identify conductors for polarity and voltage.

.2 Install with conductors sized to maintain current flow with maximum 5% voltage drop.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical .

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

.3 Waste Management: separate waste materials for recycling or reuse in accordance with Section 01 35 21- LEED Requirements or 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by central emergency lighting system installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.2 No.141-15, Emergency Lighting Equipment.

.2 CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101-2015, Life Safety Code.

.3 International Organization for Standardization (ISO)

.1 ISO 3864-1 2011, Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings.

.2 ISO 7010 2011, Safety colours and safety signs - Registered safety signs.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: extruded aluminum housing, brushed aluminum finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: LED-2W, 120 V.

.5 Operation: designed for 25 years of continuous operation without relamping.

.6 Running man snap in place universal face, directional arrows as required. Green in colour.

.7 Emergency power connection: 120V dc.

.8 Single face, ceiling or wall mounted with directional arrows as shown on the drawings.

2.2 ACCEPTABLE MANUFACTURERS

.1 Aimlite, Lumacell, Redilite, Stanpro, Beghelli.

2.3 SELF-LUMINOUS SIGNS

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Connect emergency lamp sockets to emergency circuits.

.4 Lock exit light circuit breaker in on position.

END OF SECTION

1 General

1.1 SCOPE

.1 The Contractor shall furnish and install, where indicated, a (wall mounted low voltage Quick Connection box, utilizing main lugs, mechanical connection lugs and receptacle connections as specified herein, and as shown on the contract drawings.

1.2 SUBMITTALS – FOR REVIEW/APPROVAL

.1 The following information shall be submitted to the Engineer:

- .1 Layout Sheet – Front view and plan view of the assembly
- .2 Schematic diagram
- .3 Component list
- .4 Assembly ratings including:
  - .1 Short-circuit rating
  - .2 Voltage
  - .3 Continuous current
- .5 Major component ratings including:
  - .1 Voltage
  - .2 Continuous current
  - .3 Interrupting ratings
- .6 Cable lug/ terminal sizes
- .7 CamLok connector quantities and rating

1.3 QUALIFICATIONS

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.4 REGULATORY REQUIREMENTS

.1 The low-voltage Generator connection box shall be CSA labeled.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.6 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

2 Products

2.1 MANUFACTURERS

.1 Eaton
.2 Schneider
.3 Approved Equal

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 RATINGS

.1 The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current up to 50ka at 600V symmetrical.

.2 Voltage rating to be as indicated on the drawings.

2.3 CONSTRUCTION

.1 Roll-Up Generator Quick Connect Box shall consist of painted steel components bolted or welded together to form a rigid assembly. Provide adequate ventilation within the enclosure. The enclosure shall be Stainless Steel and Nema 4X Rated.

.2 The connection box shall be provided with mechanical outgoing cable terminations, which shall be suitable for copper or aluminum conductors.

.3 Shall be equal to **Eaton type RUG** Load Bank Quick-Connect utilizing the components herein specified and as shown on the drawings.

2.4 BUS

.1 All bus bars shall be silver-plated copper. Bus ampacity as shown on drawings.
.2 Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.
.3 A copper ground bus shall be furnished where indicated.
.4 All hardware used on conductors shall be high-tensile strength and zinc-plated.

2.5 WIRING/TERMINATIONS

.1 The connection box shall be provided with both mechanical lugs and CamLok type receptacle assembly for connection of generator power phases (A, B, C), neutral and grounding conductors. All connections for phases, neutral, ground, etc., shall be clearly marked via labeling

.2 Each single pole cam-type receptacle shall be rated for no less than 400 amps at 90 deg C. Multiple receptacles per phase, neutral, and ground shall be utilized when amperages over 400 amps are requested. Contact material of the receptacle shall be composed of brass.

.3 Cam-type receptacles must be suitable for use in outdoor environments.

.4 Single pole Cam-type receptacles shall be CSA C22.2 No. 182.3 listed for Attachment Plugs and Receptacles.

.5 Small wiring, necessary fuse blocks and terminal blocks within the connection box shall be furnished as required.

2.6 ENCLOSURES

.1 Outdoor NEMA 3R Enclosure Nema 4X Rated.
.2 Provide hinged cable entry trap door to allow cable access to load bank connection receptacles and lugs while maintaining Type 3R Enclosure integrity.
.3 Doors shall have provisions for padlocking

2.7 NAMEPLATES

.1 Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

End of Section

1 General

1.1 RELATED REQUIREMENTS

.1 Divisions 26, 27, 28

.2 Latest version of ANSI/TIA-569 – Telecommunications Pathways and Spaces.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00 – Common Product Requirements.

.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 Store materials in dry location, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communication raceway systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 Products

2.1 SYSTEM DESCRIPTION

.1 Telecommunications raceway system for data, access control, CCTV consists of outlet boxes, cover plates, terminal and distribution cabinets, conduits, pull boxes, sleeves and caps, fish wires, concrete encased ducts, as indicated.

.2 Overhead ceiling distribution system within the building. Concrete encased duct bank on site under vehicular areas.

2.2 MATERIAL

.1 Conduits: Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

.2 Junction boxes, cabinets in accordance with Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets.

.3 Fish wire: polypropylene type.

.4 Provide ULC approved intumescent fire-stopping to cap all empty conduit ends, ducts, sleeves and stuffed around all cabling to seal all conduits, cable tray and cable penetrations of fire-rated rooms.

.1 Fire-stopping shall be Hilti or approved equivalent.

.5 Cable tray approved manufacturers:

.1 WBT

.2 CER

.3 Flex Tray

.4 Approved equivalent.

.6 Cable trays shall only be installed in accessible areas, as shown on drawings. Conduits shall be installed to transition through any inaccessible areas.

.7 All cable trays and support components shall be aluminum or stainless steel, basket-type and pre-galvanized. Post galvanized hot dipped trays and components are not acceptable.

.8 Cable trays shall be sized as defined on drawings.

.9 Cable trays shall be of sufficient strength to support the weight of all cabling installed within trays.

.10 Cable tray sloped waterfalls shall be used wherever cabling elevation changes occur.

.11 All cable tray waterfalls, elbows, tees, bends, dividers, etc. shall be factory manufactured.

.12 J-hooks approved manufacturer

.13 J-hooks shall only be utilized in secure areas and accessible ceiling spaces and/or as noted on drawings. J-hooks shall be utilized from stub up conduit locations to route cabling to cable trays, where cable trays are shown.

.14 Include for all structural support required for the installation of cable trays, conduits and j-hooks.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

.1 Install empty raceway system, including ceiling distribution system, fish wire, cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, concrete encased ducts, miscellaneous and positioning material to constitute complete system.

.2 Alter, at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation and any such outlet is not relocated in excess of 3m (10’) in any direction.

.3 Ensure to follow manufacturer’s instructions and specifications.

.4 All conduits and cable trays to be properly grounded.

.5 All conduits to be complete with pull-string and bushings at both ends. Conduits shall also be labelled with identifiers at both ends indicating services using the conduit.

.6 Ensure structural loading requirements are met.

.7 Ensure that all cabling pathways are free of sharp corners, edges, or bends.

.8 Conduit runs shall not exceed 33m (100’) without a pull box. Conduit runs shall have no more than two (2) 90-degree bends between pull boxes and/or conduit ends.

.9 Pull boxes shall not be used to change directions of conduit runs.

.10 Provide a minimum of 300 mm (12”) vertical clearance above cable trays. Ensure that cable tray is not inaccessible due to interferences with other systems, such as HVAC, piping and lighting, for extended lengths.

.11 Cable tray supports shall be installed on either side of the cable tray sections and shall not be installed more than 10' apart for each span.

.12 Non-continuous pathways (i.e., j-hooks) shall keep crossover to a minimum and shall be routed to follow parallel and perpendicular paths to the building structure.

.13 J-hooks shall be attached to building structure and framework only and shall be spaced a maximum of 5' apart.

.14 All systems pathways shall be fire-stopped with approved fire-stopping assembly as required by all applicable codes and standards.

.15 All cabling pathway openings, including conduits/conduit endpoints, sleeves, wall penetrations, whether used or unused, shall be fire-stopped to match the penetration and room rating. Where acoustic baffling has been installed, take appropriate measures to ensure sound baffling integrity is not compromised.

.16 All conduits are to be filled at 40% Maximum of usable sectional area. Refer to riser diagram and the wire & cables diameter table for calculation.

.17 Each conduit bend shall be a long sweep radius wherever possible. In no instance shall the inside radius or bend be less than six (6) times the internal diameter of the conduit for conduits that are 53mm (2") in diameter or less, for conduits larger than 53mm (2") the bend radius shall be no less than ten (10) times the inside diameter.

.18 The use of electrical LB (L shape elbow), LL, LR, C and T type fittings are not permitted. Only LBs designed and manufactured for communications systems are allowed where applicable.

.19 Minimum conduit size where not indicated shall be 27mm (1").

.20 All Junction boxes / Pull boxes to be in accessible areas.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Processing.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Divisions 26, 27, 28

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).

.2 CSA-C22.2 No. 232-M1988(R2004), Optical Fiber Cables.

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA), latest editions

.1 TIA-568.1 Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

.2 TIA-568.2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.

.3 TIA-568.3, Optical Fiber Cabling Components Standard.

.4 TIA-606, Administration Standard for the Commercial Telecommunications Infrastructure.

.5 TIA TSB-140, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

.6 TIA-598, Optical Fiber Cable Colour Coding.

.3 Institute of Electrical and Electronics Engineers (IEEE)

1.3 DEFINITIONS

.1 Refer to TIA/EIA-598, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.4 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fibre cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications and security systems, including voice, data, CCTV and access control.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems.

.1 Horizontal cables link work areas (CCTV locations, CAT6 drops, etc.) to telecommunications cabinet/space.

.2 Telecommunications spaces linked to main terminal/equipment room (MT/ER) in main operations building by backbone cables.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 As-built Records and Drawings:

.1 Provide Access database reflecting cable installation and cross-connections.

.2 Provide electronic drawings in AutoCAD format depicting all construction.

.3 Provide two (2) bound complete hard-copy sets of as-built records to Owner's Representative.

.1 Provide and place one hard copy of as-built records for each telecommunications space.

1.6 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 41 00 – Regulatory Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

2 Products

2.1 APPROVED MANUFACTURERS

.1 Panduit

.2 Belden

.3 Berk-Tek/Leviton

.4 Or approved equal

2.2 FOUR-PAIR 100 OHM BALANCED TWISTED PAIR CABLE

.1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or FT4 as indicated to: CSA-C22.2 No. 214, Category 6 (Cat 6)to: TIA/EIA-568.2.

.2 Access Control grade electrical transmission requirements to: CAN/CSA T529 and TSB 36.

.3 Exceeds requirements of ANSI/TIA-568.2 Category 6 and ISO 11801 2nd Edition Class E channel standards.

.4 Exceeds requirements of ANSI/TIA-568.2 and IEC 61156-5 Category 6 component standards.

.5 Meets requirements of IEEE 802.3af, IEEE 802.3at, and IEEE 802.3bt for PoE applications.

.6 UL Limited Power (LP) rated CMP-0.7A which eliminates the need to consult the PoE ampacity table in the code regarding maximum bundle sizes.

.7 Outdoor rated cabling where indicated suitable for buried conduit runs. Weather Shielded, water resistant, cUL CMR Riser Rated, UV Treated, Direct Burial Underground.

2.3 UTP 4-PAIR MODULAR JACK

.1 See Section 27 20 00 – Data Communications.

.2 All UTP telecommunications jacks shall be Category 6, T568A/B, 8P8C, single, green finish, telecommunications jack with flush exit. Unless otherwise noted on the drawings,

install each telecommunications jack in a single gang faceplate at each telecommunications outlet. The quantity of faceplate openings shall match the quantity of jacks at each location. All jacks shall be wired using the T568B wiring configuration.

2.4 TERMINATION AND CROSS-CONNECTION HARDWARE FOR UTP

.1 IDC Terminal strips, 25 pair, for terminating 4 pair 100 ohm balanced twisted pair cables and supporting cross-connections using jumper wires or compatible plug-ended patch cords: Category 6 to: TIA/EIA-568.2

.2 Mount or block for housing 12 IDC terminal strips, mounted on cabinet.

.1 Distribution rings or channels capable of externally mating with the above mount for managing cross-connection wires.

2.5 UTP CROSS-CONNECT WIRE

.1 Category 6, 4 pairs to: TIA/EIA-568.2.

2.6 UTP PATCH CORDS

.1 Factory-installed male plug at other end to mate with "RJ-45" jack to: TIA/EIA-568.2 "RJ-45" jack Category 6, 4 pairs, for cross-connect between the patch panel and the network switch. Provide one patch cord for each new camera cable installed on a patch panel

2.7 CABLE MANAGEMENT

.1 See Section 27 20 00 – Data Communications.

.2 Horizontal cable management panels shall be installed in each cabinet and rack, for every 48 ports or as indicated. Unless otherwise noted on the drawings, install one cable management panel between each patch panel and below the last patch panel.

2.8 UTP PATCH PANEL

.1 Modular (RJ45) style patch panels.

.2 Designed for high speed data, cross connect and interconnect specifications.

.3 24 or 48 ports per panel suitable for modular jacks.

.4 Provide each port with a T568A (ISDN) eight pin jack as necessary to accommodate number of runs.

.5 Provide patch panels in each data rack, quantity of panels as required to connect each data outlet to a corresponding patch panel port with a minimum of 5 (in 24 port panel) and 10 (in 48 port panel) spare ports.

2.9 UTP EQUIPMENT CABLE

.1 4 pair "pigtail", factory-installed male plug to mate with "RJ-45" jack to: TIA/EIA-568.2 Category 6.

2.10 OPTICAL-FIBER CABLE

.1 Distribution, without conductive members, multi-mode 50/125, laser-optimized, 2000 MHz km capacity, flame test classification to CSA-C22.2 No. 232, TIA/EIA-568.3, each end terminated with FT4 or OFNR, FT6 or OFNP connectors. duplex LC.

.2 Indoor/Outdoor Fiber Cables: Single mode, Number of pair as indicated, all backbone cables that exit the building envelope shall be UL listed, riser-rated, loose tube, 50/125-micron laser optimized OM3/4, indoor/outdoor, fiber optic cable meeting applicable code. riser (OFNR) standards. The cable shall utilize dry water-blocking technology, have a UV-stabilized, flame-resistant PVC outer jacket, and operate in a range from -40C to 70C.

.1 Relevant standards:

.1 ROHS Compliant

.2 ANSI/ICEA S-104-696

.3 CSA C22.2

.4 RoHS compliant

.5 ULC listed

.6 NFPA 262

.7 Telcordia GR-409

2.11 OPTICAL-FIBER CONNECTORS

.1 All fibers shall be terminated with duplex LC type connectors with ceramic ferrule adapters to: TIA/EIA-568.1.

2.12 OPTICAL-FIBER PATCH PANEL

.1 Mounted in cabinet, size as indicated on tender drawings.

.2 All fiber connector panels shall be installed with duplex LC fiber adapters with ceramic sleeve and fiber designation strip. For multimode fibers, the quantity of adapters per panel shall be determined by the number of fibers being terminated.

2.13 OPTICAL FIBER CONNECTOR HOUSING

.1 Single-drawer housing with space for horizontally mounted connector panels. Housing shall have slide-out drawer with label sheet, smoked shatterproof polycarbonate door with latch, and deep front shelf area to provide adequate strain relief for cables.

2.14 OPTICAL-FIBER PATCH CORDS

.1 Interconnect cable, 2 strands, duplex LC to: TIA/EIA-568.3. Multi-Mode 50/125, laser-optimized, 2000 MHz km capacity, 50/125-micron laser optimized OM3/4, multimode fiber cords with flame-resistant PVC outer jacket. Patch cords shall be factory terminated and tested to 10 Gb/s data rates.

2.15 OPTICAL-FIBER WORK AREA CORDS

.1 Interconnect cable, 2 strands, Duplex LC to: TIA/EIA-568.3-Multi-Mode 50/125, laser-optimized, 2000 MHz km capacity

2.16 COMMUNICATIONS/SECURITY EQUIPMENT CABINET

.1 12U or as indicated, Heavy gauge steel, NEMA 1, fully welded construction

.2 Tool-Free Quick-Mount™ system allows for easy, one-person mounting of the center section to the back pan on the jobsite.

.3 Load Capacity: minimum 300LBS

.4 Depth: up to 24”

.5 Width: up to 28”

.6 Wall mount standard with top dust cover

.7 Secure cable management through knockouts, horizontal managers and abundant built-in cable lacing points in interior

.8 Perforated front and rear doors, provides excellent air flow

.9 2 x 19” EIA adjustable, cage-nut style, mounting rails are provided with adjustable rackrail bracket

.10 Hardware package (c/w 12 cage-nuts and screws)

.11 Center section hinges for left or right opening accessories

.12 15A power strip, steel, surge protected, with corded cable type, grounding/bonding stud and mounting hardware to include 6 outlets; termination type 5-15P; CAN/CSA and ROHS compliant.

.13 All doors are lockable and lift off for ease of equipment and cable installation

.14 Lock/key standard

.15 Grounding as per code and Owner requirement

.16 Manufacturers:

.1 Panduit PZWMC series

.2 Middle Atlantic Products

.3 Chatsworth Products

.4 Or approved equal.

2.17 CABLE BUNDLING MATERIALS

.1 Provide hook and loop tape, that is at least 0.5 inches wide of a length equal to 150% of the circumference of the cable bundle.

.2 Tie wraps are not allowed on this project.

.3 When used in areas considered environmental air spaces, all bundling materials must be appropriately listed.

3 Execution

3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

.1 Install termination and cross-connect hardware on wall, in cabinet as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606.

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables as indicated in conduits from telecommunication spaces to individual work-area jacks. Identify and label as indicated to: TIA/EIA-606.

.2 Support horizontal cables at intervals not exceeding 2 metres.

.1 Where raceways are used to distribute cables to each zone, provide supplementary "J" hooks to support cables at intervals not exceeding 2 metres.

.3 Install horizontal cables from consolidation point to individual work-area jacks.

.1 Provide supplementary "J" hooks to support cables at intervals not exceeding 2 metres.

.2 Identify and label as indicated to: TIA/EIA-606.

.4 Terminate horizontal cables in telecommunications room and at individual work-area jacks.

.1 Identify and label as indicated to: TIA/EIA-606.

.5 Coil spare cables and store in ceiling space in zone.

.6 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.

3.3 INSTALLATION OF BACKBONE CABLES

.1 Install backbone cables from each telecommunications space to main terminal/equipment room (MT/ER) in Main Operations Building as indicated and according to manufacturers' instructions.

.1 Identify and label as indicated to: TIA/EIA-606.

3.4 INSTALLATION OF EQUIPMENT CABLES

.1 Install equipment cables from equipment patch panel as indicated.

.1 Identify and label as indicated to: TIA/EIA-606.

3.5 INSTALLATION OF WALL MOUNTED CABINET

.1 Install wall-mount equipment cabinets in accordance with manufacturer’s instructions and Owner’s IT requirements at locations indicated on the Drawings.

.2 Install wall-mount equipment racks plumb, level, square, and secure on 21mm fire retardant plywood backboard.

.3 These racks are to be installed with the front rails set back from the inside of the cabinet by 120mm. This is to allow proper cable bend radius requirements when the cabinet door is closed

.4 Protect installed wall-mount equipment racks from damage during construction

3.6 IMPLEMENT CROSS-CONNECTIONS

.1 Implement cross-connections using patch cords as specified.

3.7 FIELD QUALITY CONTROL

.1 Refer to Section 27 05 13 - Communication Services for general testing requirements.

.2 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as electronic record.

.1 Perform tests for Permanent Link on installed cables, including spares:

.1 Category 6 using certified level III tester to: TIA/EIA-568.2.

.2 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from each telecommunications space, including shortest and longest drops from each telecommunications room: should more than 5% of tested cables fail, test remaining cross-connected data cables.

.1 Category 6 using certified level III tester to: TIA/EIA-568.2.

.3 Test backbone UTP cables as specified below and correct deficiencies: provide record of results as electronic record.

.1 Category 6 cable to meet ANSI standard x3T9.5 (capable of data transmission up to 1 G. bps).

.2 Perform system and channel tests after UTP cable installation to ensure that installation meets standard indicated. Tests to be performed using a Level IV tester. Minimum tests to be performed.

.1 Wire Map

.2 Continuity.

.3 Attenuation.

.4 Near End Crosstalk (NEXT).

.5 Resistance.

.6 Length of Cable.

.7 Return loss

.8 ELFEXT

.9 PS NEXT Loss

.10 ACR-F Loss

.11 PS ACR-F Loss

.12 Propagation delay.

.13 Delay skew.

.3 Perform permanent link tests to cover all equipment wiring including patch panels and line cords. Perform tests from telecommunication space outwards to work area.

.4 Provide to Owner's Representative written copy of the testing sequence to be performed, testing equipment to be used, and standards to which cable is being tested.

.5 Provide a written report to the Owner's Representative each cable tested and the results of the testing. Provide printout from the Level IV tester for each cable.

.4 Test Optical-fiber strands for attenuation to: TIA/EIA-568.1 and correct deficiencies: provide record of results as electronic record.

.1 Test horizontal links need at only one wavelength (850 nm or 1300 nm) and in one direction.

.1 Attenuation to be less than 2.0 dB.

.2 Test backbone links in both directions. Backbone links:

.1 Test multi-mode fibre at both applicable wavelengths (850 nm and 1300 nm).

.3 Maximum attenuation: Cable attenuation + Connector loss + Splice loss.

.1 Multi-mode-fiber atténuation coefficients:

.1 3.5 db/km @ 850 nm; and

.2 1.5 db km @ 1300 nm

.2 Maximum connector insertion loss: 0.75 db per pair and maximum splice insertion loss: 0.3 db.

.5 Perform additional Tier 2 tests using optical time domain reflectometer (OTDR) on horizontal, backbone fibre pairs to: TSB-140.

.1 Correct deficiencies.

.2 Provide record of results as described in SUBMITTALS.

.6 Replace cable and/or connection equipment that fails tests.

.7 Provide additional testing in accordance with Section 01 91 00 – General Commissioning Requirements.

.8 Provide record of results as electronic record to: TIA/TSB-140.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Common Work Results for Electronic Safety and Security Section 28 05 00

1.2 DEFINITIONS

.1 "CCTV" shall mean Closed Circuit Television. The CCTV includes (but not limited to) the 4K/POE/IP-based Cameras, Video Management System (VMS), CCTV Server, CCTV Monitor, CCTV Software Licenses, Cat6 Structured Cabling System (SCS), Security Conduit System, Pull Boxes, System Programming Manual, System Operation Manual, and Training Manual.

.2 "IDS" shall mean Intrusion Detection System. It includes (but not limited to) the IDS Main Control Panel (with 8-board zones), IDS Monitor, IDS Software Licenses (if required), Control Cabinet, Lock-keys, Power Supplies, Batteries, Motion Detectors, Glass break Detectors, Security Wiring System, Security Conduit System, System Programming Manual, System Operation Manual, and Training Manual.

.3 "ACS" shall mean Access Control System. It includes (but not limited to) the ACS Panel with Door Controllers, ACS Server, ACS Monitor, ACS Software Licenses, Power Supplies, Batteries, Door Contacts (DC), Card Readers (CR), Keypad (KP), Electric Strikes (ES), Magnetic Locks (ML), Request-to-Exit (REX) devices, Security Wiring, Security Conduit System, System Programming Manual, System Operation Manual, and Training Manual.

.4 "N.I.C" shall mean Not in Contract.

.5 "STP" shall mean Shielded Twisted Pair cable.

1.3 SCOPE OF WORK

.1 Install the Access Control System as specified herein and indicated on the drawings, including all miscellaneous materials and labour to complete the intent of the Work.

.2 Comply with all Common Work Results for Electronic Safety and Security.

.3 Supply , install and configure all required licenses.

1.4 SYSTEM DESCRIPTION

.1 The Access Control System shall be compatible and integral part of the existing Airport Authority ACS system and shall be fully accessible at the Airport Authority security office.

.1 This integration will leverage Secured Internet Connection by means of IP VPN or other approved secured connection mediums.

.2 The Fort McMurray Airport Authority current ACS system is C•CURE 9000 by software house.

.3 The existing ACS system is scalable and the proponent must ensure it can accommodate the new facility and additional gates.

1.5 QUALITY ASSURANCE - CERTIFICATION

.1 Manufacturer Qualifications: The Manufacturer of SECURITY MANAGEMENT SYSTEM (SMS) software and hardware components must be established vendors for no less than five years and successfully implemented five systems of similar size and complexity.

.2 Security System Integrator Qualifications: Regularly engaged in installation and maintenance of integrated access control systems with proven track record for similar systems.

.1 Supply Verification for the following:

.1 Entity is an authorized and certified SMS product integrator. One technician must be a Certified SMS installer.
.2 Installation and service technicians are competent, factory trained, certified, capable of system maintenance, and provide reasonable service time.
.3 Three references whose systems are of similar complexity and installed and maintained by entity in the last five years.
.4 There is a local representative and factory authorized local service organization that carries a complete stock of parts and provide maintenance for systems.

1.6 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, and data sheets for the ACS equipment, and required accessory devices including product features, performance criteria, physical size, finish and limitations.

.2 Submit the following documents:

.1 Functional description of equipment.
.2 Technical datasheets for all ACS devices.
.3 Devices mounting location detail drawings.
.4 Typical devices connection detail drawings.

.3 Shop Drawings:

.1 Shop drawings to indicate ACS layouts, mounting height and location on drawings, detail wiring diagrams, etc.

.2 Complete wiring diagram, including riser diagram.

.3 Complete description of the system operation.

.4 Complete description of each component and module.

.4 Manufacturer's Instructions: Submit manufacturer's installation instruction manuals.

.5 Manufacturer's Field Reports: Submit manufacturer's written reports within 5 days of review, verifying compliance of work.

.6 As-built Records and Drawings:

.1 The As-built Records and Drawings are to be submitted in accordance with the Section 01 78 00 – Closeout Submittal.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 The Security Contractor shall be responsible for the storage and handling of all materials required by the ACS for this project.

.2 Storage and Protection: Any materials that show signs of mishandling or have been stored in a fashion so as to reduce the value of the materials shall be replaced with new materials at no additional cost to the Owner.

.3 Protect store materials from environmental and temperature conditions following manufacturer's instructions. Handle and operate products and systems according to manufacturer's instructions.

.4 Deliver materials in manufacturer's original, unopened, undamaged containers, and unharmed original identification labels.

.5 Waste management and disposal procedures.

1.8 PROJECT CONDITIONS

.1 During the ACS installation, testing, and commissioning process; the Security Contractor shall maintain the environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance (O&M) Data: Submit maintenance data for incorporation into the O&M manual.

.1 Include:

.1 ACS system configuration and equipment physical layouts.

.2 ACS functional description of equipment.

.3 Instructions for the O&M of equipment.

.4 Illustrations and diagrams to O&M supplement procedures.

.5 O&M instructions provided by manufacturer.

.6 Record Drawings

1.10 WARRANTY

.1 All components, parts, and assemblies supplied by the manufacturers and installed by the Security Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.

.2 Service/Maintenance:

.1 System maintenance and repair of the ACS system or workmanship defects during the warranty period shall be provided by the Security Contractor free of charge (parts and labor)

.2 Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.

.3 The Security installer shall correct any system defect within six hours of receipt of call from the Owner.

.4 Extended service/maintenance agreements shall be offered by the Security Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

1.11 PREFERRED MANUFACTURERS

.1 The ACS controller hardware is to be equal, or equivalent, or similar to the following manufacturer list, below.

Products/Materials	Preferred Manufacturers
Software House	iSTAR Ultra/Ultra SE/Ultra LT
Software House	iSTAR Ultra G2/Ultra SE G2

Software House	iSTAR EDGE/EDGE G2

2 Products

2.1 MATERIALS

2.2 ACCEPTABLE MANUFACTURERS

.1 All devices shall be compatible with the selected access control manufacturer through industry standard protocols such as Wiegand, OSDP, dry contact inputs, outputs, Etc.

.2 Door controllers shall be compatible with existing Access Control System.

2.3 ACCESS CONTROL SYSTEM SERVERS

.1 The Security Contractor shall supply and configure the required licenses for all new doors on the existing ACS server and shall be managed from the Fort McMurray Airport Operation Centre.

.2 Confirm software version and ensure compatibility between provided firmware and software environment.

2.4 ACCESS CONTROL ASSEMBLIES

.1 All head end access control equipment shall be furnished in standardized enclosure assemblies conforming to industry best practices.

.2 Access control assemblies shall be assembled, and factory acceptance tested within a controlled fabrication environment and shall conform to industry standards.

.3 Access control assemblies shall be fitted with all hardware in as space efficient a design as possible, and shall allow for easy termination, maintenance, and troubleshooting of internal components. Hardware, cabling, and cable management within access control assemblies shall not be stacked or overlapping.

.4 Access control assemblies shall be equipped with Tamper Switches permanently installed on the internal lip of the enclosure.

.5 For exterior applications, access control assemblies shall bear NEMA 4X or higher environmental rating, and shall be outfitted with appropriate heating and thermostat components to maintain a minimum operating temperature of -45°C.

.6 Internal power distribution shall be supplied and installed to provide power supply and distribution within the enclosure.

.7 Size power components to accommodate worst-case power draw of all components. Provide multiples of power supply and distribution as required by internal power usage of electronic components within enclosure.

2.5 BATTERIES

.1 As recommended by the ACS manufacturer

.2 Access control assemblies shall be battery backed up to allow for minimum one (1) hour of continuous operation in the event of a power failure.

2.6 ACCESS CONTROL SYSTEM HEAD END DEVICES

.1 Software House iSTAR Ultra SE ACM controller

.1 Powerful network-ready door controller for up to 32 readers

.2 Number of Readers Supported, per ACM Board 8

.3 Supports Wiegand signaling and RM (RS-485) Reader Technologies Supported, Multi-Technology, Proximity, Smart Card (incl. PIV II & TWIC), Wiegand, and Magnetic Stripe (RM only)

.4 System Memory of 2 GB RAM

.5 SD Storage of 16 GB SD card

.6 Primary Network Port supports 10/100/1000 Mbps, full duplex, auto-negotiate.

.7 Secondary Network Port supports 10/100/1000 Mbps, full duplex, auto-negotiate.

.8 Network Encryption supports Optional AES 256-bit, with custom key Management (Ultra mode only); Pro mode does not support RSA RC4 encryption.

.2 Software House GCM board

.1 Door controller Unit

.2 System Memory of 2 GB RAM

.3 SD Storage of 16 GB SD card

.4 Shall monitor on a per door basis, door position, request-to-exit, two and (2) auxiliary alarm inputs.

.5 Be capable of controlling the electrified locking hardware by schedule, command on, command off, and pulse.

2.7 ACCESS CONTROL DOOR POWER SUPPLIES AND CABINET

.1 150W output power reduces fan noise.

.2 12VDC and/or 24VDC outputs

.3 Single or dual voltage, standard or network managed

.4 Multiples of eight (8) Access Control System trigger inputs, configured Normally Open or Open Collector

.5 Multiples of eight (8) independently controlled outputs, configured Fail-Safe or Fail-Secure, form “C” relay outputs.

.6 Multiples of eight (8) auxiliary (unswitched) power outputs rated at 2.5A each.

.7 Fire alarm disconnect (latching or non-latching), individually selectable by output.

.8 Alarm output relay indicating FACP input is triggered.

.9 Zero voltage drop when unit switches over to battery backup.

.10 Thermal and short-circuit protection with auto reset.

.11 AC fail supervision (form “C” contact)

.12 Basis of design: LifeSafety Power

2.8 ACCESS CONTROL SYSTEM FIELD DEVICES

.1 Card Readers

.1 Wiegand, Clock-and-Data and RS-485 Half Duplex (OSDP) via Pigtail (18 in / 0.5 m) or Terminal Strip

.2 Supports multi-technology proximity

.3 Input Voltage: 5-16VDC at 250 mA peak

.4 Card Readers shall be:

.1 Single gang for standard (default) applications
.2 Integrated with keypad for applications combining standard card reader and keypad where required
.3 Mobile Ready

.5 Compatibility with Seos, iCLASS SE™, iCLASS SR, iCLASS, MIFARE Classic, MIFARE DESFire EV1/EV2/EV3, and Classic card technologies.

.6 Suggested product: HID Signo Reader

.2 Request-to-Exit Devices

.1 Passive infrared detector with Digital Signal Processing filter

.2 Curtain-type Fresnel detector lens

.3 Adjustable relay timer from 0.5 to 60 seconds

.4 Reg/Green indicator light

.5 Input: 12-28VDC, 50mA

.3 Door Position Sensors

.1 All door position sensors shall be recessed with wide gap.

.2 Where door position switches are to be monitored by the Access Control System in addition to another system or function, double-pole double-throw switches shall be used.

.3 Overhead door shall have track mounted door position sensors with appropriate brackets.

.4 For standard door installations, contact shall be installed on the top of the frame.

.4 Access Control Cards

.1 Supply one hundred (100) cards/fobs as currently in use by the owner.

2.9 ACCESS CONTROL SYSTEM INTERCOMS

.1 IP based intercom specification

.1 A network-based communication and security system featuring video entry security, internal communication, emergency stations, and paging. All units and app in the systems shall be able to unlock doors remotely on a network, assist onsite visitors from an offsite location, broadcast emergency announcements, and communicate using a PoE network.

.2 Security Contractor shall furnish all software and licenses required for operation intercom telephony system.

.3 Peer-to-peer network based.

.4 IP Desktop Video Station

.1 Network Interface: 10 BASE-T / 100 BASE-TX Ethernet

.2 LCD Screen with embedded video

.3 Large high contrast display with backlight for excellent readability

.4 Four dynamic navigation keys for access to system menus and directory entries

.5 Active noise cancellation, acoustic echo cancellation, and high output power amplifier

.5 IP Vandal Resistant Video Door Station

.1 1/3-inch 8-type color CMOS. 720p HD, wide dynamic range

.2 Relay output for remote control of doors, signals, lamps, etc.

.3 Tamper resistant robust housing with front plate.

.4 IP65 protection to front.

.5 Connections: RJ45 10/100, Power over Ethernet

.6 Integrated day/night video camera

.7 Supply and install all mount hardware or adapters as required.

2.10 LOCKING DEVICES

.1 It shall be the responsibility of the Security Contractor to coordinate scope of supply of all electronic locking devices.

.2 The Security Contractor shall coordinate all electronic requirements to ensure compatibility with access control hardware.

.3 Subject to approval by the Authority Having Jurisdiction, the default door configuration shall be fail-secure with free egress. Coordinate all locking requirements with existing openings and mechanical hardware.

3 Execution

3.1 INSTALLATION

.1 Supply, install, terminate, configure, and test an Access Control System inclusive of hardware and software licensing, for the purpose of door access control and input/output monitoring.

.2 Install Access Control System as specified herein and indicated on the drawings, including all miscellaneous materials and labour to complete the intent of the Work

.3 Supply and installation of access control enclosure(s), complete with the following components:

.1 Supply and installation of Network controller, Door board, power supplies, power distribution, and battery backup.

.2 Lockable cabinet enclosure, back panel, cable management, batteries, and cabinet tamper device.

.3 Factory Acceptance Testing of assembly. See Section 28 08 00 Commissioning of Electronic Safety and Security.

.4 Supply and install card readers, request-to-exit devices, sirens, door position switches, electronic locking devices, and other physical security equipment as shown on drawings.

3.2 TESTS

.1 System testing and commissioning shall be carried out by qualified personnel of the manufacturer.

.2 Upon system completion and verification, conduct a witness inspection for the manufacturer to demonstrate the system operation to the Owner's representative.

.3 The system supplier will conduct a system testing and inspection upon completion of the installation. The installation shall comprise of the following:

.1 To verify that equipment installed is that designated by this Specification;

.1 To verify the operation of the entire system is as specified.

.2 To verify that the installation of the system is in accordance with the manufacturer's instructions and in accordance with all applicable Codes of governing bodies having jurisdiction.

.3 An acceptance test in the presence of and to the satisfaction of the Project Manager.

.4 Providing a copy of the inspecting technician's report showing location of each device and certifying the test results of each device shall be forwarded to the Construction Manager.

3.3 TRAINING AND MAINTENANCE

.1 The contractor shall provide a minimum of 12 hours in three different sessions within three months for instructing the Owner's maintenance and security personnel in the operation of the system.

.2 The contractor shall be responsible in maintaining the equipment in good working order for a period of at least one year from Substantial Performance without compensation. Transfer any extended warranty available from manufacturer to the Owner without extra charge.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 34 – Conduits, Conduit Fastenings, and Conduit Fittings

.2 Section 27 05 26 – Grounding and Bonding for Communications Systems

.3 Section 27 05 28 – Pathways for Communications Systems

.4 Section 28 13 00 – Access Control System

.5 Section 28 31 00 – Intrusion Detection System

1.2 REFERENCE CODES & STANDARDS – LATEST VERSION

.1 The equipment, materials and installation for the Closed-Circuit Television (CCTV) Video Surveillance System shall comply and conform to the latest version of the following applicable codes, standards (including technical service bulletins and Addenda), guidelines, reference handbooks, and regulations of authorities having jurisdiction (AHJ).

CSA C22.1 1-2018, 24th Ed.	Canadian Electrical Code, Part I
ITSG-11A	COMSEC Installation Planning – Guidance and Criteria
ANSI/TIA-568.0-D	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568.1-D	Commercial Building Telecommunications Cabling Standard
ANSI/TIA-569-D	Telecommunications Pathways and Spaces
ANSI/TIA-606-C	Administration Standard for Telecommunications Infrastructure
ANSI/TIA-607-C	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

1.3 DEFINITIONS

.1 "CCTV" shall mean Closed Circuit Television. The CCTV includes (but not limited to) the 4K/POE/IP-based Cameras, Video Management System (VMS), CCTV Server, CCTV Monitor, CCTV Software Licenses, Cat6 Structured Cabling System (SCS), Security Conduit System, Pull Boxes, System Programming Manual, System Operation Manual, and Training Manual.

.2 "IDS" shall mean Intrusion Detection System. It includes (but not limited to) the IDS Main Control Panel (with 8-board zones), IDS Monitor, IDS Software Licenses (if required), Control Cabinet, Lock-keys, Power Supplies, Batteries, Motion Detectors, Glass break Detectors, Security Wiring System, Security Conduit System, System Programming Manual, System Operation Manual, and Training Manual.

.3 "ACS" shall mean Access Control System. It includes (but not limited to) the ACS Panel with Door Controllers, ACS Server, ACS Monitor, ACS Software Licenses, Power Supplies, Batteries, Door Contacts (DC), Card Readers (CR), Keypad (KP), Electric Strikes (ES), Magnetic Locks (ML), Request-to-Exit (REX) devices, Security Wiring, Security Conduit System, System Programming Manual, System Operation Manual, and Training Manual.

.4 "N.I.C" shall mean Not in Contract.

.5 "STP" shall mean Shielded Twisted Pair cable.

1.4 SCOPE OF WORK

.1 The Security Contractor is to provide a complete CCTV system consisting of 4K/PoE/IP-based Cameras, CCTV Server, Video Management System (VMS), Network Video Recorder (NVR), CCTV Software Licenses, Cat 6A-STP cables, conduits, pull boxes, and all devices required to make a complete and operative CCTV system as described herein.

.2 Supply and install fixed, multi-lens, and PTZ IP surveillance cameras as shown on drawings.

.3 Supply and install all CCTV system servers and software required for archiving and management of video surveillance equipment, inclusive of all licensing requirements for Video Analytics and Privacy Protection.

.4 Supply and install all cabling, connectors, terminations, and testing required for connection of video surveillance equipment.

.5 Supply and install power supplies as required for surveillance cameras and related accessories., Power over Ethernet (PoE) shall be utilized to provide power to the cameras, wherever practicable.

.6 Perform all CCTV configurations within security management system environment.

.7 The Electrical Contractor (Division 26) shall provide all security conduit system for the CCTV. For conduit details, refer to the Section 26 05 34 and 27 05 28 Specifications.

1.5 SYSTEM DESCRIPTION

.1 The CCTV System shall be fully integrated with the existing Airport Authority CCTV system and shall be fully accessible at the Airport Authority security office.

.1 This integration will leverage Secured Internet Connection by means of IP VPN or other approved secured connection mediums.

.2 The existing Fort MacMurray Airport Authority CCTV system platform is Panasonic i-Pro.

.2 The CCTV System shall be comprised of hardware and software components that function together with all Related Systems to provide a complete integrated operating system.

.3 The CCTV shall require no proprietary field device or server hardware to operate.

.4 The CCTV shall be scalable to thousands of cameras.

.5 The CCTV shall provide distributed administration and video viewing activities and shall be capable of restricting access to functions of the live video and administrative interfaces by user, zone, or group.

1.6 QUALITY ASSURANCE - CERTIFICATION

.1 Manufacturer Qualification:

.1 The CCTV system manufacturer shall have been in business manufacturing similar products for at least 5 years.

.2 Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standards.

.2 Installer Qualification:

.1 The Security Contractor shall be registered as a Certified Security Installer for the installation and maintenance of the CCTV system from the acceptable security Manufacturer(s). The Security Contractor shall have at least five years of experience installing CCTV, ACS, and IDS systems.

.2 All CCTV products are to be by a single Manufacturer unless otherwise stated in this document.

.3 The Security Contractor selected for this project must provide a Manufacturer’s Certification to confirm training received from the manufacturer (s) prior to start of work.

.4 The Security Contractor shall engage manufacturer for commissioning and certifying of manufacturers’ equipment hardware and software two weeks prior to substantial completion of work.

.5 The Security Contractor shall be factory-trained and certified to maintain/repair the system after system acceptance.

1.7 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, and data sheets for the CCTV cameras, VMS software, VMS server, monitoring screens, and required accessory devices including product features, performance criteria, physical size, finish and limitations.

.2 Submit the following documents:

.1 Functional description of equipment.

.2 Technical datasheets for all CCTV devices.

.3 Devices mounting location detail drawings.

.4 Typical devices connection detail drawings.

.3 Shop Drawings:

.1 Shop drawings to indicate CCTV layouts, mounting height and location of the keypad on drawings, detail wiring diagrams, etc.

.2 Complete wiring diagram, including riser diagram.

.3 Complete description of the system operation.

.4 Complete description of each component and module.

.3 Manufacturer's Instructions: Submit manufacturer's installation instruction manuals.

.4 Manufacturer's Field Reports: Submit manufacturer's written reports within 5 days of review, verifying compliance of work.

.5 As-built Records and Drawings:

.1 The As-built Records and Drawings are to be submitted in accordance with the Section 01 78 00 – Closeout Submittal.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 The Security Contractor shall responsible for the storage and handling of all materials required by the CCTV for this project.

.2 Storage and Protection: Any materials that show signs of mishandling or have been stored in a fashion so as to reduce the value of the materials shall be replaced with new materials at no additional cost to the Owner.

.3 Protect store materials from environmental and temperature conditions following manufacturer's instructions. Handle and operate products and systems according to manufacturer's instructions.

.4 Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.

.5 Waste management and disposal procedures.

1.9 PROJECT CONDITIONS

.1 During the CCTV installation, testing, and commissioning process; the Security Contractor shall maintain the environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance (O&M) Data: Submit maintenance data for incorporation into the O&M manual.

.1 Include:

.1 CCTV system configuration and equipment physical layouts.

.2 CCTV functional description of equipment.

.3 Instructions for the O&M of equipment.

.4 Illustrations and diagrams to O&M supplement procedures.

.5 O&M instructions provided by manufacturer.

.6 Record Drawings

1.11 WARRANTY

.1 All components, parts, and assemblies supplied by the manufacturers and installed by the Security Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.

.2 Service/Maintenance:

.1 System maintenance and repair of the CCTV system or workmanship defects during the warranty period shall be provided by the Security Contractor free of charge (parts and labor)

.2 Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.

.3 The Security installer shall correct any system defect within six hours of receipt of call from the Owner.

.4 Extended service/maintenance agreements shall be offered by the Security Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

1.12 PREFERRED MANUFACTURERS

.1 The CCTV products/materials are to be equal, or equivalent, or similar to the following manufacturer list, below.

Products/Materials	Preferred Manufacturers
CCTV IP-based, PoE, 4K-Cameras	Panasonic, AXIS Communications, Bosh, Hanwha Techwin, or approved equivalent
Video Management System (VMS)	Panasonic i-Pro
Network Video Recorder (NVR)	Panasonic i-Pro SR3E, or approved equivalent
Network Video Recorder Failover	Panasonic i-Pro SR1XL, or approved equivalent

2 Products

2.1 MATERIALS

.1 Provide all system materials/components and mounting equipment required to make a complete and operational system as indicated in the specifications and recommended field of view.

.2 A camera could also be interfaced with security system that will focus on an alarm situation such as a door that is on an alarm (exit doors or specifically programmed doors) schedule. In that case the event must be recorded.

2.2 CCTV CAMERAS

.1 Fixed Camera

.1 Indoor Fixed Camera

.1 2688×1520-pixel image up to 30fps

.2 iA (intelligent Auto)

.3 Super Dynamic 102dB

.4 Color night vision (0.019 to 0.3 lx)

.5 H.265 Smart Coding

.6 Corridor mode (90 degrees or 270 degrees in image rotation)

.7 Built-in IR LED

.8 NDAA Compliant

.2 Outdoor Fixed Camera

.1 4K Outdoor Vandal Dome camera

.2 Up to 9 Edge AI analytic apps

.3 Compatible with AI On-site learning app

.4 Enables AI image analysis on non-AI cameras (with AI Processing Relay app)

.5 IP66, IP67, IK10 certified.

.6 NDAA Compliant

.2 PTZ Camera

.1 Camera

.1 4K 30x PTZ camera

.2 Innovative New Form Factor PTZ

.3 Up to 3 Edge AI analytic apps

.4 AI auto tracking

.5 Built-in IR-LED (200m/656ft)

.6 High speed Pan/Tilt drive (Pan: 700deg./s, Tilt: 500deg./s)

.7 Heavy salt damage resistance specifications (ISO 14993 compliant)

.8 IP66, IK10 certified.

.9 NDAA Compliant

.2 Multi-Directional Cameras

.1 Four Sensors

.1 4 x 4MP or 5 MP - 2688x1520 up to 30fps

.2 360° coverage with one IP address

.3 Intelligent Auto (with AI Engine)

.4 Super Dynamic 108dB

.5 Color night vision (0.21 to 0.3 lx)

.6 Smart Coding (with AI Engine)

.7 Remote zoom and focus

.8 Continuous view assistance

.9 Wide range tilt angle adjustment mechanism

.10 NDAA Compliant

.4 Dual Sensor Camera

.1 2 x 4K Multi-directional camera

.2 One IP address, One VMS license

.3 Up to 4 Edge AI analytic apps

.4 Built-in IR-LED（40m, 131ft）

.5 Wide angle of view (Horizontal 104°)

.6 Corridor mode (90 degrees or 270 degrees in image rotation)

.7 IP66, IP67, IK10 certified.

.8 NDAA Compliant

2.3 ENTERPRISE NETWORK VIDEO RECORDER (NVR)

.1 Provide 1 x Enterprise NVR server with 24/7, 60-day recording retention storage, at maximum resolution, and 30 fps recording rate on motion; and 5fps always recording. The recording parameters consider Codec H.264 or H.265 with a compression of 30% and duty cycle of 12 hours on motion. The NVR server shall be able to record all cameras of the entire building (consider an extra capacity of 20% to support future extra cameras).

.2 The Enterprise NVR server is to be based on recording/encoding mirrored technology for the recording engine, database of all cameras, and integrated hardware/software components. The Enterprise NVR is to be able to provide full failover functionalities without zero lost of recording events and full continuity of records. It must have redundant power supplies.

.3 The Enterprise NVR server is to have RAID array to store all video data associated with the entire CCTV system. It is to be capable of recording simultaneous records, archive, live view, playback, and transmit video frames.

.4 Enterprise NVR Technical Features:

.1 Mounting: Rack Mount NVR Server,

.2 Processor: 2 x Xeon Silver 16-Core / 32-Thread, or better

.3 Operating System: Windows Server 2022 Standard

.4 Hard Drive: OS on 2 x M.2 High Speed SSD Drives (RAID 1)

.5 Storage: Up to 12 x 3.5” SAS Enterprise Drives (Storage RAID 5),

.6 RAM Memory: 64 GB,

.7 LAN Interface: 1GBE Quad Base-T & 10GBE Dual SFP+

.8 Power Supply: 2 x 1100W Power Supply Hot-Swap

2.4 CCTV REDUNDANT SERVERS

.1 Provide 1 x failover server for the CCTV system. The server must be installed with the VMS and all required features as per the manufacturer recommendations. This server shall present 25% of storage for video surveillance failover.

.2 Failover Server Technical Features:

.1 Mounting: Rack Mount NVR Server,

.2 Processor: 1 x Intel Xeon 6-Core / 12-Thread

.3 Operating System: Windows Server 2022 Standard

.4 Hard Drive: OS on 1 x M.2 High Speed SSD Drive

.5 Storage: Up to 4 x 3.5” SAS Enterprise Drives (Storage RAID 5),

.6 RAM Memory: 32 GB,

.7 LAN Interface: 2 x 1GBE Port

.8 Power Supply: 2 x 600W Power Supply

2.5 VIDEO MANAGEMENT SYSTEM (VMS)

.1 Provide VMS to control all CCTV cameras, recording, viewing and all system functions.

.2 System shall be provided with all necessary VMS software to control cameras, record and view camera images, archive camera images and program and control all system functions. Supply licenses for a minimum of 100 IP-based, 4K cameras.

.3 The VMS shall provide the capability of running a client application in additional to the VMS.

.4 The Security Contractor is to confirm with the Owner the recommended VMS server hardware specifications and approved VMS server manufacturer before ordering to site.

.5 The VMS shall be capable of recording greater than 60 days using the following parameters:

.1 Resolution – 4K (2160p)

.2 Video Mode – NTSC

.3 Quality – High

.4 Sensitivity – High

.5 Aggregate Record Rate – 30 frames per second (minimum)

.6 Number of Cameras – As required for all floors.

.7 The VMS Operating System (OS) shall be Microsoft Windows 10/Windows Sever to provide increased reliability, security, and performance.

.8 The VMS shall provide for simultaneous recording, playback, transmitting, database searching and archiving.

.9 The VMS shall provide network access through two internal network connections that support 2 GB network operation.

.10 The unit must simultaneously record, play back and archive video, text and audio while using sophisticated search functions to define and find only those important events that

meet certain criteria. The system must also have the ability to host multiple remote users, archive data, and search for data, all while recording multiple video and text streams.

.11 The VMS live video display must provide real-time motion in any screen format (full, 2x2, 3x3, and 4x4). The operator shall have the ability to expand any view to full screen with a single click of the mouse.

.12 The VMS shall have the ability to capture critical information with higher frame rates for certain cameras, and assign the remainder of the available images per second (ips) to non-critical cameras.

.13 The VMS shall allow for the following Alarm Recording settings:

.1 Image Rate

.2 Quality

.3 Sensitivity

.14 The VMS must include the ability to send an email via an email server to anyone, or any group, based upon an event. The events must include, but not necessarily limited to, the following:

.1 System Event

.2 Video Loss

.3 Generated Alarm

.4 Any Filter Alarm

.5 Any Input Alarm

.6 Individual Camera Alarm.

.15 The VMS shall easily integrate with third party software application using an Application Programmers Interface (API). The manufacturer of the unit shall offer a Software Developers Kit (SDK) to select third party manufactures, in addition to sample modular programs with their source codes in both Visual Basic and Visual C++, allowing programmers to develop their own software to control the unit's functions.

.16 The VMS shall be compatible with the leading brands of anti-virus software in order to detect and deactivate malicious software that may attempt to attack the system.

.17 The VMS must include support for Remote Configuration and Management software to allow a user to remotely configure the unit, view live video, or select video segments by time, date, alarm, or search results. The operator must have the ability to save, annotate, and organize copied video into "incident folders" to aid with investigations.

3 Execution

3.1 INSTALLATION

.1 Install the CCTV system, including the Cat6A cables, CCTV cameras, pull boxes, conduits, and miscellaneous positioning material to constitute a complete system. Coordinate with other disciplines.

.2 All conduit system shall be installed by Division 26. For conduit details, refer to the Section 26 05 34 and 27 05 28 Specifications.

.3 Conduits shall not have more than 3 90 deg. or equivalent bends in each run, with the bending radii not less than 10 times the conduit dia. Pull boxes shall be provided in each conduit run at intervals of not more than 100' (30 m).

.4 All conduits shall be run above suspended ceiling or concealed in walls, and shall be co ordinated with other services.

.5 Provide all wires and cable and leave adequate loose cable in the device boxes and termination boxes for cable termination.

.6 Confirm exact locations of all components prior to roughing in.

3.2 TESTS

.1 System testing and commissioning shall be carried out by qualified personnel of the manufacturer.

.2 Upon system completion and verification, conduct a witness inspection for the manufacturer to demonstrate the system operation to the Owner's representative.

.3 The system supplier will conduct a system testing and inspection upon completion of the installation. The installation shall comprise of the following:

.1 To verify that equipment installed is that designated by this Specification;

.2 To verify the operation of the entire system is as specified.

.3 To verify that the installation of the system is in accordance with the manufacturer's instructions and in accordance to all applicable Codes of governing bodies having jurisdiction.

.4 An acceptance test in the presence of and to the satisfaction of the Project Manager.

.5 Providing a copy of the inspecting technician's report showing location of each device and certifying the test results of each device shall be forwarded to the Construction Manager.

3.3 TRAINING AND MAINTENANCE

.1 The contractor shall provide a minimum of 12 hours in three different sessions within three months for instructing the Owner's maintenance and security personnel in the operation of the system.

.2 The contractor shall be responsible in maintaining the equipment in good working order for a period of at least one year from Substantial Performance without compensation. Transfer any extended warranty available from manufacturer to the Owner without extra charge.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 34 – Conduits, Conduit Fastenings, and Conduit Fittings

.2 Section 27 05 26 – Grounding and Bonding for Communications Systems

.3 Section 27 05 28 – Pathways for Communications Systems

.4 Section 28 13 00 – Access Control Systems

.5 Section 28 23 00 – CCTV Video Surveillance

1.2 REFERENCE CODES & STANDARDS – LATEST VERSION

.1 The equipment, materials, and installation for the Intrusion Detection System (IDS) shall comply and conform to the latest version of the following applicable codes, standards (including technical service bulletins and Addenda), guidelines, reference handbooks, and regulations of authorities having jurisdiction (AHJ).

CSA C22.1 1-2018, 24th Ed.	Canadian Electrical Code, Part I
ITSG-11A	COMSEC Installation Planning – Guidance and Criteria
ANSI/TIA-968-B-2016	Technical Requirements for Connection of Terminal Equipment to the Telephone Network
CAN/ULC-S304:2016	Standard for Control Units, Accessories and Receiving Equipment for Intrusion Alarm System
CAN/ULC-S302-14	Standard for the installation, inspection and Testing of intrusion Alarm Systems
CAN/ULC-S306-03	Intrusion Detection Units
CAN/ULC-S318-96 (R2016)	Standard for Power Supplies for Burglar Alarm Systems
ULC-ORD-C604 (R2016)	Connectors and Switches for use with Burglar Alarm Systems
ULC-ORD-C1076	Proprietary Burglar Alarm Units and System
ICES-003-2014	Information Technology Equipment (ITE) — Limits and Methods of Measurement for Discussion — Data Breach Notification and Reporting Regulations
UL 50	Enclosures for Electrical Equipment
UL 294	Access Control System Units
UL 365	Police Station Connected Burglar Alarm Units and Systems
UL 603	Standard for Power Supplies for Use with Burglar-Alarm Systems
UL 609	Local Burglar Alarm Units and Systems
UL 864	Control Units and Accessories for fire Alarm Systems (Commercial Fire)
UL 1076	Proprietary Burglar Alarm Units and Systems
UL 1610	Central Station Burglar-Alarm Units
UL 60950-1	Information Technology Equipment - Safety
UL 636	Hold up alarms

Important: All CAN/ULC standards are applied to equipment/products, materials and installation methods. They are not applied to specific company name, brand name, or trade name.

1.3 DEFINITIONS

.1 “IDS” shall mean Intrusion Detection System. It includes (but not limited to) the IDS Main Control Panel (with 8-board zones), IDS Server, IDS Monitor, IDS Software Licenses, Control Cabinet, Lock-keys, Power Supplies, Batteries, Motion Detectors, Glass break Detectors, Security Wiring System,

Security Conduit System, System Programming Manual, System Operation Manual, and Training Manual.

.2 "ACS" shall mean Access Control System. It includes (but not limited to) the ACS Panel with Door Controllers, ACS Server, ACS Monitor, ACS Software Licenses, Power Supplies, Batteries, Door Contacts (DC), Card Readers (CR), Keypad (KP), Electric Strikes (ES), Magnetic Locks (ML), Request-to-Exit (REX) with Motion Detectors, Request-to-Exit Switch (RX), Security Wiring, Security Conduit System, System Programming Manual, System Operation Manual, and Training Manual.

.3 "CCTV" shall mean IP Closed Circuit Television. The CCTV includes (but not limited to) the 4K/PoE/IP-based Cameras, Video Management System (VMS), CCTV Server, CCTV Monitor, CCTV Software Licenses, Cat6 Structured Cabling System (SCS), Security Conduit System, Pull Boxes, System Programming Manual, System Operation Manual, and Training Manual.

.4 "N.I.C" shall mean Not in Contract.

.5 "STP" shall mean Shielded Twisted Pair cable.

1.4 SYSTEM DESCRIPTION – SCOPE OF WORK

.1 The Security Contractor is to provide a functionally complete Intrusion Detection System (IDS) consisting of the following equipment hardware, software, programing, and all accessories to make a complete and operative IDS described herein.

.2 Provide all IDS required hardware such as IDS server, IDS monitor, touchscreen keypads, zone expansion modules IDS panels, batteries (12V, 7A), transformers (16V, 40VA), and IDS security devices (MD, GD, DC) as required.

.3 Shall present Dual-Path communication. Ready to communicate with the Airport Security office or a third-party central station monitoring.

.4 Provide double-pole, double-throw door contacts for the IDS and ACS systems.

.5 The IDS system shall be able to arm/disarm zones/partitions via automated schedules and zone keypads.

.6 The IDS shall present an ACS card reader for arming and disarming, installed close to each IDS keypad.

.7 The IDS shall be able to accommodate test, diagnostics, and configuration programming functions locally or remotely via a portable programmer or a computer running the IDS MSAS.

.8 The IDS shall annunciate alarm, trouble, service reminders, and other relevant system status messages in custom English, and French Canadian texts.

.9 The Electrical Contractor (Division 26) shall provide all end-to-end security conduit system for the IDS. For conduit details, refer to the Section 26 05 34 and 27 05 28 Specifications.

.10 The IDS shall be programed to provide required partitions in various areas as per the Owner requirements.

1.5 QUALITY ASSURANCE - CERTIFICATION

.1 Manufacturer Qualification:

.1 The IDS system manufacturer shall have been in business manufacturing similar products for at least 5 years.

.2 Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standards.

.1 Installer Qualification:

.3 The Security Contractor shall be registered as a Certified Security Installer for the installation and maintenance of the IDS system from the preferred/selected security Manufacturer(s). The Security Contractor shall have at least five years of experience installing IDS, ACS, and CCTV systems.

.1 All IDS products are to be by a preferred/selected Manufacturer unless otherwise stated in this document.

.2 The Security Contractor selected for this project must provide a Manufacturer's Certification Number to confirm training received from the manufacturer (s) prior to start of work.

.3 The Security Contractor shall engage manufacturer for commissioning and certifying of manufacturers' equipment hardware and software two weeks prior to substantial completion of work.

.4 The Security Contractor shall be factory-trained and certified to maintain/repair the system after system acceptance.

1.6 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, and data sheets for the MSAS, security control panels, keypads, control cabinets/enclosures, power supplies, low-voltage transformers, batteries, IDS security devices, security cables, and detection accessory devices including product features, performance criteria, physical size, finish, and limitations.

.2 Submit the following documents:

.1 Functional description of equipment.

.2 Technical datasheets for all security devices.

.3 Device location plans including zone records and partitions.

.4 Security wining/cabling schedule lists.

.5 Devices mounting location detail drawings.

.6 Typical devices connection detail drawings.

.3 Shop Drawings:

.1 Shop drawings to indicate security device location, mounting height and location of the keypad on drawings, detail wiring diagrams, etc.

.2 Submit zone layout drawings indicating numbers, locations of zones and areas covered.

.4 Manufacturer's Instructions: Submit manufacturer's installation instruction manuals.

.5 Manufacturer's Field Reports: Submit manufacturer's written reports within 5 days of review, verifying compliance of work.

.6 As-built Records and Drawings:

.1 The As-built Records and Drawings are to be submitted in accordance with the Section 01 78 00 – Closeout Submittal.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 The Security Contractor shall responsible for the storage and handling of all materials required by the IDS.

.1 Storage and Protection: Any materials that show signs of mishandling or have been stored in a fashion so as to reduce the value of the materials shall be replaced with new materials at no additional cost to the Owner.

.2 Protect store materials from environmental and temperature conditions following manufacturer's instructions. Handle and operate products and systems according to manufacturer's instructions.

.3 Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.

.4 Waste management and disposal procedures.

1.8 PROJECT CONDITIONS

.1 During the IDS installation, testing, and commissioning process; the Security Contractor shall maintain the environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance (O&M) Data: Submit maintenance data for incorporation into the O&M manual.

.1 Include:

.1 IDS system configuration and equipment physical layouts.

.2 IDS functional description of equipment.

.3 Instructions for the O&M of equipment.

.4 Illustrations and diagrams to O&M supplement procedures.

.5 O&M instructions provided by manufacturer.

1.10 WARRANTY

.1 All components, parts, and assemblies supplied by the manufacturers and installed by the Security Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.

.2 Service/Maintenance:

.1 System maintenance and repair of the IDS system or workmanship defects during the warranty period shall be provided by the Security Contractor free of charge (parts and labor)

.2 Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.

.3 The Security installer shall correct any system defect within six hours of receipt of call from the Owner.

.4 Extended service/maintenance agreements shall be offered by the Security Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

1.11 PREFERRED MANUFACTURERS

.1 The IDS products/materials are to be equal, or equivalent, or similar to the following preferred manufacturers list, below.

Products/Materials	Preferred Manufacturers
IDS Control Panels (with 8-board zones)	DSC PowerSeries Pro (Johnson Controls), Honeywell, Bosh North America
TouchScreen Security Interface Keypad	DSC PowerSeries Pro (Johnson Controls), Honeywell, Bosh North America

Power Supplies	DSC PowerSeries Pro (Johnson Controls), Honeywell, Bosh North America
Cabinets/Enclosures	DSC PowerSeries Pro (Johnson Controls), Honeywell, Bosh North America
Motion Detectors and Glassbreak Detectors	DSC PowerSeries Pro (Johnson Controls), Honeywell, Bosh North America
IDS Servers and Workstations	Dell, HP
Accessories (Door Contacts, Tamper Switches/Detectors)	Various

2 Products

2.1 MATERIALS

.1 Manufacturer:

.1 All IDS products are to be by a preferred/selected Manufacturer unless otherwise stated in this document.

.2 Material and equipment: The IDS will have the following components.

Item	Description	Type	Notes
1	IDS Control Panels with 8 on-board zones	IDS Main Controller	Quantities as indicated on drawings.
2	Power Supply Modules	Power Supply	Quantities as required.
3	Transformer (16V, 40VA)	Power Supply	Quantities as required.
4	Batteries (12V, 7A)	Battery	Quantities as required.
5	TouchScreen Security Interface Keypad (TSKP)	Keypad	Quantities as required.
6	Motion Detectors (MD)	Sensor	Quantities as required.
7	Glassbreak Detector	Sensor	Quantities as required.
9	IDS Control Cabinet/Enclosures	IDS Main Controller	Quantities as required.
10	Accessories	Various	Quantities as required.

.3 IDS Design Criteria:

.1 The IDS shall use only ULC/UL and CSA certified listed products.

.2 The IDS shall use a company specializing in IDS systems.

.3 The IDS as a modular access control, alarm monitoring system expandable, and easily modified for inputs, outputs and remote expansion modules/stations.

.4 The IDS components are to be in accordance with CAN/ULC-S306 and be capable of:

.1 Annunciating undesirable, abnormal or dangerous condition.

.2 Prioritizing alarms by alarm type; i.e. panic/duress, intrusion and tamper.

.3 Determining zone where alarm occurred.

.4 Annunciating power failure and power restoration.

.5 Annunciating low battery condition.

.6 Operate continuously for minimum period of 4 hours in the event of a power failure.

.5 IDS control panels with continuous tamper detection on door and wall.

.1 Tamper detection to trigger trouble light.

.6 Design system with:

.1 Alarm masking.

.2 Remote maintenance or diagnostics with password activation.

.3 Unique identifier for each authorized person.

.4 Arming and disarming capabilities: manual and automatic by time of day, day of week, or by operator command.

.5 Support both manual and automatic responses to alarms entering system.

.6 Each alarm capable of initiating different functions of camera, homing, and activation of remote devices, audio switching, door control and card or pin validation.

.7 Zone or alarm location annunciated at monitoring station.

.8 Communications link: security level of III to CAN/ULC-S304.

.9 Signal link: security level of III to CAN/ULC-S304.

.10 Alarm condition: design system to provide maximum time for an alarm to be communicated of 90 seconds from alarm initiation to annunciation at remote monitoring location.

.11 Junction boxes: All junction boxes inside the secure side have to include tamper switches (continuous tamper-detection capability) with silent alarms and recording events to identify the junction box locations by the IDS & ACS systems.

.12 Design system power supplies rated to provide cumulative load of all systems components plus safety factor of 50% or greater.

.7 IDS Control Panel: ULC approved, expandable and designed for multiplexed expansion.

.1 Zones (protection inputs): All exterior doors, entrance doors of TRs, TCs, and Server Rooms as indicated on drawings.

.2 Fixed zones per expansion modules: 8.

.3 Expandable: 16 - 128 zones.

.4 Number of user codes required: 4.

.5 Number of areas/partitions: As required.

.6 TouchScreen Security Interface Keypad: As required, refer to security layout drawings.

.7 Hardwired Keypads: LCD liquid crystal display.

.8 Alarm: local, monitored.

.9 System: Wire (wireless not required)

.10 Integrated with sub systems such as (ACS)

.11 Number of programmable outputs required: Refer to riser diagram.

.12 System supervision: Mobile communicator (built-in Ethernet) and AC power.

.13 Siren output.

.14 Number of devices per zone: As zone required.

.8 Detection Accessories:

.1 Contacts: All door contacts are to be dedicated for the IDS. They are to be provided by Door Hardware Supplier.

.9 Communications: Mobile communicator.

.10 Connectors and switches: to ULC-C634.

.11 Power supplies: to ULC-S318, UL 603.

3 Execution

3.1 INSTALLATION

.1 Install intrusion detection panel and components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.

.2 Install panels, intrusion detection system and components secure to walls, ceilings or other substrates.

.3 Install required boxes in inconspicuous accessible locations.

.4 Conceal conduit and wiring.

3.2 SITE TEST AND INSPECTION

.1 Perform verification inspections and test in the presence of Consultant.

.1 Provide necessary tools, ladders and equipment.

.2 Ensure appropriate subcontractors and manufacturer's representatives are present for verification.

.2 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:

.1 Sturdiness of equipment fastening.

.2 Non-existence of installation related damages.

.3 Compliance of device locations with reviewed shop drawings.

.4 Compatibility of equipment installation with physical environment.

.5 Inclusion of all accessories.

.6 Device and cabling identification.

.7 Application and location of ULC approval decals.

.3 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of coverage patterns.

.2 Connecting joints and equipment fastening.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

.4 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:

.1 Operation of each device individually and within its environment.

.2 Operation of each device in relation with programmable schedule and or/specific functions.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written reports from Manufacturer verifying compliance of work, in handling, installing, applying, protecting and cleaning of product.

.2 Submit 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 Ensure Manufacturer's representative is present before and during critical periods of installation, testing.

.4 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 complete, but before installation begins.

.2 Upon completion of work, after cleaning is carried out.

3.4 ADJUSTING

.1 Set up and adjust all IDS components for correct function.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by intrusion detection installation.

3.6 TRAINING

.1 Include three (3) hours of training per session for designated staff in three (3) different sessions within six (6) months of completing the work. The training will be conducted on the premises and will include at least two (2) staff members. The trainer will be a qualified individual accredited by the manufacturer. As part of the training the Owner will be provided with “Cheat Sheets”.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for fire alarm systems.

.2 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.

.3 Trouble signal devices.

.4 Power supply facilities.

.5 Manual alarm stations.

.6 Automatic alarm initiating devices.

.7 Audible signal devices.

.8 End-of-line devices.

.9 Annunciators.

.10 Visual alarm signal devices.

.11 Ancillary devices.

.2 Related Requirements

Section 01 00 50 – General Requirements

Section 01 33 00 - Submittal Procedures

Section 01 78 00 - Closeout Submittals

Section 01 91 13 – General Commissioning Requirements

Section 26 05 00 – Common Work Results for Electrical

Section 26 05 05 – Selective Demolition for Electrical

Section 27 05 13 – Communications Services

1.2 REFERENCE STANDARDS

.1 Government of Canada

.1 TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.

.2 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

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

.1 Material Safety Data Sheets (MSDS).

.3 National Fire Protection Agency

.1 NFPA 72-2002, National Fire Alarm Code.

.2 NFPA 90A-2002, Installation of Air Conditioning and Ventilating Systems.

.4 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

.5 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC-S525, Audible Signal Device for Fire Alarm Systems.

.3 CAN/ULC-S526, Visual Signal Devices for Fire Alarm Systems.

.4 CAN/ULC-S527, Control Units.

.5 CAN/ULC-S528, Manual Pull Stations for Fire Alarm Systems.

.6 CAN/ULC-S529, Smoke Detectors for Fire Alarm Systems.

.7 CAN/ULC-S530, Heat Actuated Fire Detectors for Fire Alarm Systems.

.8 CAN/ULC-S531, Standard for Smoke Alarms.

.9 CAN/ULC-S536-S537, Burglar and Fire Alarm Systems and Components.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00- Submittal Procedures.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00- Submittal Procedures.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00- Submittal Procedures.

.1 Shop drawings: stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Include:

.1 Layout of equipment.

.2 Zoning.

.3 Complete wiring diagram, including schematics of modules.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00- Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

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

.4 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00- Closeout Submittals in accordance with ANSI/NFPA 20.

.2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.

.3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.

.4 Submit following:

.1 Manufacturer's Data for:

.1 Control panel and modules.

.2 Storage batteries.
.3 Battery charger.
.4 Remote annunciator panel.
.5 Graphic annunciator panel.
.6 Master fire alarm boxes.
.7 Auxiliary transmitter.
.8 Master box pedestal.
.9 Radio master box pedestal.
.10 Master box.
.11 Radio master box location light.
.12 Radio fire alarm master box.
.13 Radio fire alarm auxiliary transmitter.
.14 Radio fire alarm interface panel.
.15 Combination auxiliary transmitter and interface panel.
.16 Freeze protection thermostatic switch.
.17 Wiring.
.18 Conduit.
.19 Outlet boxes.
.20 Fittings for conduit and outlet boxes.
.21 Trouble buzzer.
.22 Surge Protection Devices – Surgepure or approved equal.
.23 Mark data which describe more than one type of item to indicate which type will be provided.
.24 Submit 1 original for each item and clear, legible, first-generation photocopies for remainder of specified copies.

.2 System wiring diagrams:
.1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
.2 Show modules, relays, switches and lamps in control panel.
.3 Provide a wiring diagram at each building.
.4 Provide a wiring diagram for monitoring system in building 186 system.

.3 Design data: Power Calculations:
.1 Submit design calculations for existing system and new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.
.2 Show comparison of notification appliance circuit alarm power requirements with rated circuit power output.

.4 Instructions for operation:
.1 Provide a detailed schedule for the following phased scope of work:
.1 Demolition of existing transmitters complete with all wiring back to building 192 and building 186.
.2 Paint to match existing and repair all anchor bolt holes at the wall where the transmitter was removed.

.3 Coordinate the DND/DCC for fire watch coordination for each building in scope.

.5 Schedules:

.1 Conductor wire marker schedule.

.6 Test Reports:

.1 Preliminary testing:

.1 Final acceptance testing.

.2 Submit for inspections and tests specified under Field Quality Control.

.3 Commissioning report.

.4 Fire alarm verification report.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in fire alarm system installations approved by manufacturer.

.2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

.3 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to Fire Commissioner of Canada (FC) approval.

.3 Subject to FC inspection for final acceptance.

.4 To Canadian Forces Fire Marshal approval.

.4 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.

.5 Maintenance Service:

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to DCC Representative and Consultant.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturers recommendation.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Not Used.

2.2 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to CAN/ULC-S525.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual pull stations: to CAN/ULC-S528.

.7 Thermal detectors: to CAN/ULC-S530.

.8 Smoke detectors: to CAN/ULC-S529.

.9 Smoke alarms: to CAN/ULC-S531.

2.3 SYSTEM OPERATION

.1 Not Used.

2.4 CONTROL PANEL

.1 Class A and B.

.2 Two and Single stage operation.

.3 Zoned.

.4 Coded.

.5 Enclosure:

.1 CSA Enclosure 1, c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.

.2 Provide modular type panel installed in surface mounted steel cabinet with hinged door and cylinder lock.

.3 Mount with panel centerline 1.5 m above finished floor elevation.

.4 Switches and other controls: not accessible without use of key.

.5 Design of control panel: neat, compact assembly containing parts and equipment required to provide specified operating and supervisory functions of system.

.6 Control panel components: CSA approved and approved by control panel manufacturer for use in control panel.

.7 Panel cabinet: finished on inside and outside with factory-applied enamel finish.

.8 Provide main annunciator located on exterior of cabinet door or visible through cabinet door.

.9 Provide audible trouble signal.

.10 Provide permanent engraved metal identification plates, silk-screened labels attached to rear face of panel viewing window, for lamps and switches.

.11 Provide 1 set of Form C dry alarm contacts per zone, common system Form C dry alarm contact, and common system Form C dry trouble contact. Indicate set/unset condition of auxiliary transmitter by control panel.

.12 Permanently label switches.

.13 Provide panel with following switches:

.1 Trouble silencing switch which silences audible trouble signals including remote trouble devices without extinguishing trouble indicating lamp(s).

.1 For non-self-resetting type switch: Upon correction of trouble condition, audible signals will again sound until switch is returned to its normal position.

.2 For silencing switch of momentary action self-resetting type: trouble signal circuit automatically restored to normal upon correction of trouble condition.

.2 Evacuation alarm silencing switch which when activated will silence alarm notification appliances without resetting panel, and cause operation of system trouble signals. Subsequent alarm(s) from additional zone(s) not originally in alarm to cause activation of notification appliances even with alarm silencing switch in "silenced" position.

.3 Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of system and zone trouble signals.

.4 Reset switch which when activated will restore the system to normal standby status after cause of alarm has been corrected, and activated initiating devices reset.

.1 Operation of reset switch to restore activated smoke detectors to normal standby status.

.5 Lamp test switch.

.6 Drill switch which will enable test of notification appliances and restoration to normal without tripping master box.

.7 Master box disconnect switch which when activated will disconnect coded device and cause operation of system trouble signal.

.8 HVAC shutdown bypass switch. Operation of the switch to allow HVAC system to operate with detectors in alarm and cause operation of system trouble signals.

.6 Supervised, modular design with plug-in modules:

.1 Alarm receiver with trouble and alarm indications, for class B initiating circuit.

.2 Spare zones: compatible with smoke detectors and open circuit devices.

.3 Space for future modules.

.4 Latching type supervisory receiver circuits. Discrete indication for both off-normal and trouble.

.7 Components:

.1 Coded alarm receiver panel with trouble and alarm indications for class B initiating circuit.

.2 Single stage alarm pulse rate panels:

.1 Single stroke control type for output to signal control panel continuously.

.3 Audible signal control panel with connections.

.4 Common control and power units:

.1 Control panel containing following indications and controls:

.1 "Power on" LED (green) to monitor primary source of power to system.

.2 "Power trouble" indication.

.3 "Ground trouble" indication.

.4 "Remote annunciator trouble" indication.

.5 "System trouble" indication.

.6 "System trouble" buzzer and silence switch c/w trouble resound feature.

.7 System reset switch.

.8 "LED test" switch if applicable.

.9 "Alarm silence" switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.

.10 "Signals silenced" indication.

.2 Master power supply panel to provide 24 V dc to system from 120 V ac, 60 Hz input.

.3 Fire department connections:

.1 Plug-in module for shunt type municipal box.

.2 Fire department bypass switch c/w indicator for trouble at panel.

.5 Auxiliary relays: plug-in type, dust cover, supervised against unauthorized removal by common trouble circuit and c/w individual bypass switch.

.1 Contacts: 2.0 A, 120 V ac, for functions such as release of door holders or initiation of fan shut down.

.2 Contact terminal size: capable of accepting 22-12 AWG wire.

2.5 POWER SUPPLY

.1 120 V, ac, 60 Hz input, 24 V dc output from rectifier to operate alarm and signal circuits, with standby power of gell cell batteries minimum expected life of 4 years, sized in accordance with NBC.

2.6 MANUAL ALARM STATIONS

.1 To operate at new Node panel similar to existing panel.

2.7 AUTOMATIC ALARM INITIATING DEVICES

.1 To operate at new Node panel similar to existing panel.

2.8 ALARM INITIATING DEVICE SPACING AND LOCATION

.1 To operate at new Node panel similar to existing panel.

2.9 DUCT SMOKE DETECTORS

.1 To operate at new Node panel similar to existing panel.

2.10 PROJECTED BEAM SMOKE DETECTOR

.1 To operate at new Node panel similar to existing panel.

2.11 AUDIBLE SIGNAL DEVICES

.1 To operate at new Node panel similar to existing panel.

2.12 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.13 REMOTE ANNUNCIATOR PANELS

.1 Not required.

2.14 GRAPHIC ANNUNCIATOR PANEL

.1 Provide panel located as shown.

.2 Mount with panel centerline 1.5 m above finished floor elevation.

.3 Panel: interior type, surface mounted.

.4 Panel: provided with building floor plan, drawn to scale, with alarm lamps mounted to represent location of each initiating device.

.5 Panel graphic: show locations of annunciator panel and control panel and have "YOU ARE HERE" arrow showing its location. Orient building floor plan on graphic to location of person viewing graphic, i.e. direction viewer is facing is toward top of graphic display. Provide North arrow.

.6 Label principal rooms and areas shown with titles and room numbers.

.7 Provide detectors mounted above ceilings, on ceilings, beneath raised floors and different types of initiating devices with different symbols and lamps of different colours for identification. Lamps to illuminate upon activation of corresponding device and remain illuminated until system is reset.

.1 Provide panel with lamp test switch.

2.15 VISUAL ALARM SIGNAL DEVICES

.1 To operate at new Node panel similar to existing panel.

2.16 FREEZE PROTECTION THERMOSTATIC SWITCH

.1 To operate at new Node panel similar to existing panel.

2.17 ELECTRO-MAGNETIC DOOR HOLDER-RELEASES

.1 To operate at new Node panel similar to existing panel.

2.18 VALVE TAMPER SWITCHES

.1 To operate at new Node panel similar to existing panel.

2.19 OFF-PREMISES FIRE ALARM

.1 To operate at new Node panel similar to existing panel.

2.20 MASTER FIRE ALARM BOXES

.1 To operate at new Node panel similar to existing panel.

2.21 AUXILIARY TRANSMITTER

.1 Not required.

2.22 ALARM TRANSMITTER

.1 Not required.

2.23 GROUNDING

.1 Ground each Network Cabinet by connection from grounding terminal connection of box to existing building common ground bar.

.1 Resistance to ground: not exceed 10 ohms.

2.24 MASTER BOX PEDESTAL

.1 Not Used.

2.25 RADIO MASTER BOX PEDESTAL

.1 Not Used.

2.26 LOCATION LIGHT

.1 Not Used.

2.27 CONDUIT

.1 Electrical Metallic Tubing (EMT)

.2 Surface Metal Raceway and Fittings:

.1 Two-piece painted steel.

.2 Totally enclosed snap-cover type.

2.28 WIRING

.1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.

.2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor

.3 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.

.4 Wire for connection to base telegraphic alarm loop: No. 12 AWG minimum solid copper conductor.

.5 Insulation 75 degrees C minimum with nylon jacket.

.6 For underground or wet allocations cable from control panel to auxiliary transmitter and to telegraphic loop: type UF.

.7 Colour code wiring.

2.29 SURGE SUPPRESSION

.1 Provide surge protection. SurgePure or approved equal.

2.30 LINE VOLTAGE SURGE SUPPRESSOR

.1 Not Used.

2.31 LOW VOLTAGE SURGE SUPPRESSOR

.1 Not Used.

2.32 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: on black lamacoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

2.33 HALON SYSTEM

.1 Not Used.

2.34 SEQUENCE OF OPERATION FOR HALON SYSTEM

.1 Not Used.

2.35 ANCILLARY DEVICES

.1 Not Used.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Install new Node panel adjacent to existing fire alarm panel in each of the buildings in the scope of work complete with power from the closest panel in the building. Provide conduit from the new Node panel to the existing LAN room in each building. Wiring shall be completed by DND/DCC.

.3 Install new user computer in the main alarm monitoring room (124) in Building 186 and connect to ac power supply, dc standby power.

.4 Connect alarm circuits to main computer head end.

.5 Install end-of-line devices at end of alarm and signalling circuits.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical and CAN/ULC-S537.

.2 Fire alarm system:

.1 Test fire alarm panel in each of the site buildings to ensure the connectivity to the main monitoring system in building 186 via TCP/IP LAN Network. All wiring shall be completed by DND/DCC.

.2 Simulate grounds and breaks on alarm and signalling circuits in each building to ensure proper operation of system.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 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, as directed in PART 1 - QUALITY ASSURANCE.

.3 Verification requirements. Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Low-emitting materials.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

.1 Proceed in accordance with site conditions and requirements and Section 01 74 00 Cleaning and 01 74 19 Waste Management and Disposal.

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

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 20 Wire and Box Connectors (0-1000V)

.2 Section 26 05 21 Wires and Cables (0-1000V)

.3 Section 26 05 22 Connectors and Terminations

.4 Section 26 05 33 Raceway and Boxes for Electrical Systems

1.2 REFERENCE STANDARDS

.1 Codes shall include but not be limited to the following:

.2 Local Building Code.

.3 Canadian Electrical Code, Part 1 CSA Standard C22.1, particularly Section 32 - Fire Alarm Systems.

.4 Underwriters' Laboratories of Canada Standards including:

.5 CAN/ULC-S524, Installation of Fire Alarm Systems.

.6 ULC-S525, Audible Signal Appliances for Fire Alarm.

.7 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

.8 CAN/ULC-S527, Control Units, Fire Alarm.

.9 CAN/ULC-S528, Manual Pull Stations.

.10 CAN/ULC-S529, Smoke Detectors, Fire Alarm.

.11 CAN/ULC-S530, Heat Actuated Fire Detectors, Fire Alarm.

.12 CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.

.13 CAN/ULC-S537, Verification of Fire Alarm Systems.

1.3 SYSTEM DESCRIPTION

.1 Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital/multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signaling to monitoring agency.

.3 Zoned, non-coded single stage.

.4 Modular in design to allow for future expansion.

.5 Upon the operation of any alarm initiating device, cause distinctive alarm signal throughout building to warn persons that fire emergency exists.

.6 Indicate on annunciators' zone in which alarm was initiated.

.7 Alarm sounding devices to sound for at least 1 minute, after which they may be manually silenced (acknowledged) at alarm control panel.

1.4 SYSTEM TO INCLUDE

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, program control/signaling, smoke evac fan control.

.2 Also incorporate the following requirements:

.1 Logic to be computer/microprocessor based.

.2 Manufacturer to provide program changes as required.

.3 Power supplies

.4 Initiating/input circuits

.5 Output circuits.

.6 Auxiliary circuits

.7 Wiring

.8 Manual and automatic initiating devices

.9 Audible and visual signaling devices.

.10 End-of-line resistors.

.11 Local annunciators and 8-line displays (must be capable of displaying 8 events without scrolling).

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 System to meet the requirements of the local authority having jurisdiction.

.2 System components: listed by ULC and comply with applicable provisions of Alberta Building Code, Local Building Code, and meet requirements of local authority having jurisdiction.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00

.2 Include:

.1 Detail assembly and internal wiring diagrams for control unit.

.2 Overall system riser wiring diagram identifying control equipment, initiating zones, signaling circuits; identifying terminations, terminal numbers, conductors and raceways.

.3 Details for devices.

.4 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.

1.7 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for fire alarm system for incorporation into manual specified in Section 26 05 00.

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.4 List of recommended spare parts for system.

1.8 TRAINING

.1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

1.9 ACCEPTABLE MANUFACTURERS

.1 Chubb Fire and Security

.2 Notifier by Vipond

.3 Siemens

.4 Johnson Controls

2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S524.

.4 Control unit: to CAN/ULC-S527.

.5 Manual pull stations: to CAN/ULC-S528.

.6 Thermal detectors: to CAN/ULC-S530.

.7 Smoke detectors: to CAN/ULC-S529.

.8 Signal communication: to CAN/ULC – S561

2.2 GENERAL REQUIREMENTS

.1 Contractor to supply and install fully supervised micro processor/microcomputer based multiprocessing integrated fire alarm system. System to utilize standard bus architecture for local input/output and multiplexing techniques for data acquisition, distribution and control.

.2 System to utilize microprocessor/microcomputer technology and include system hardware, software and memory, in addition to all switches, indicating devices (light emitting diodes) and other necessary electronic hardware (including cables and fittings) for peripherals. System to be modular in its design to allow for future expansion.

.3 Operation of system to not require personnel with special operating skills.

.4 Provide passive graphic annunciator provisions in cabinet adjacent to the Fire Alarm Annunciator panel at the principal fire fighting entrance.

.5 Provide passive graphic annunciator at entrance door locations where shown on floor plans and riser diagram.

.6 Actuation of any alarm initiating device to:

.1 Cause electronic latch to lock-in alarm state at central control unit.

.2 Indicate zone of alarm at central control unit.

.3 Transmit signal to fire department via fire alarm dialer equipment

.4 Cause horn/strobes to operate.

.5 Release of security doors

.7 Acknowledging alarm: indicated at central control unit.

.8 Possible to silence signals by "alarm silence" switch at control unit, after silencing inhibit timer has timed out.

.9 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.10 Actuation of supervisory devices to:

.1 Cause electronic latch to lock-in supervisory state at central control unit.

.2 Indicate respective supervisory zone at central control unit and annunciator panel.

.3 Cause audible signal at central control unit and annunciator panel to sound.

.4 Activate common supervisory sequence.

.11 Resetting alarm/supervisory device not to return system indications/functions back to normal until control unit has been reset.

.12 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.

.13 Trouble on system to be suppressed during course of alarm.

.14 Trouble condition on any circuit in system not to initiate any alarm conditions.

2.3 CONTROL PANEL

.1 Central control unit (CCU)

.1 Suitable for DCLA communication style: to CAN/ULC-S524.

.2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.3 Minimum capacity of 500 addressable monitoring and 500 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other.

.4 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.5 Integral power supply, battery charger and standby batteries (sized to meet minimum code requirements).

.6 Basic life safety software: programmable for field editing of simple software functions (e.g., zone labels, priorities) and changing of system operation software.

.7 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.8 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.

.9 Software and hardware to maintain time of day, day of week, day of month, month and year.

.10 Provide line isolation for all input and output data loops at panels.

2.4 COMMON CONTROL

.1 Fire alarm/common control to provide interface between operator, remote initiating devices, audible signal appliances, and auxiliary output circuits.

.2 Common control to interface with central processor unit and Input/Output controller to provide functional microcomputer for fire alarm system.

.3 Common control to provide the following operator system indicators and controls:

.1 Power On LED (green) to monitor primary source of power (L1) to system.

.2 Power On LED (green) to monitor internal power on DC or secondary source of power (L2) on AC system.

.3 Power On LED (Green) to monitor secondary source of power (L2) on an AC system.

.4 System on Standby LED (amber).

.5 Standby trouble LED (amber).

.6 Ground fault LED (amber).

.7 System trouble silence switch: system to provide subsequent trouble feature to re-sound trouble signal, if silenced.

.8 Alarm signals silenced (LED) amber; illuminates when alarm signals are silenced manually. System to provide subsequent alarm feature to re-sound trouble signal, if silenced.

.9 Fire Dept./common contact disconnected LED (amber) disconnect switch and alert/activated LED (red).

.10 System reset switch.

.4 System to include Customer Connect Module to provide contact operation to transmit alarm signal to ULC dialer equipment and facility BMS system.

.5 Central processor unit to provide programming, data storage and system timing functions.

.6 Central processor unit to interface with Input/Output Control Module.

.7 Input/Output Controller (IOC) to off load CPU to handle data transfer to and from I/O circuits.

.8 IOC to interface to Input/Output driver (IOD) and Input/Output Receiver (IOR) for expanded system capabilities.

.9 Interface modules: facilitate connection of non-addressable devices (e.g., flow switch) to system, provided in different types for connection to monitoring devices (e.g., flow/tamper switch), signalling devices and control functions (e.g., fan shutdown, door release); communicate with system over minimum number of wires (specified by manufacturer).

.10 Possible to connect all types of addressable interface modules to same addressable communication loop.

.11 Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

2.5 DATA GATHERING PANELS (DGP'S)

.1 Fire control modules: distributed throughout building in separately enclosed units (DGP'S) and interconnected to central control unit utilizing peer-to-peer data transmission techniques.

.2 Fire alarm integrated DGP's: microprocessor based, provide interface between standard alarm input/output devices and central control unit.

.3 Each DGP: circuitry with ability to detect failure in communication with CCU resulting from faults in communication wiring. In event of loss of communication with CCU, DGP capable of operating in stand-alone mode. In this mode, DGP capable of reacting to connected

input devices, and apply stand-alone programming to determine state of connected outputs. Stand-alone programming instructions: independent of, but capable of executing same type of algorithms as, that of CCU.

.4 Each DGP: self-contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.

.5 Addressable DGP's.

.1 DGP's: addressable type, provide two-way data communication with up to 250 addressable devices/interface modules, utilizing digital poll/response protocol communication format. Each addressable device: uniquely identified by own address, set at time of installation.

.2 Addressable DGP's: stand-alone capability.

.3 Interface modules: facilitate connection of non-addressable devices (e.g. flow switch) to addressable DGP; provided in different types for connection to monitoring devices (e.g. flow/tamper switch), signalling devices (e.g. bells, horns, speakers), and control functions (e.g. fan shutdown, door release); communicate with addressable DGP over minimum number of wires (specified by manufacturer).

.4 Possible to connect all types of addressable interface modules to same addressable communication loop.

.5 Addressable DGP's: self-contained, as specified.

.6 Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

2.6 POWER SUPPLIES

.1 120 V, 60 Hz, 1 Phase as emergency circuit as primary source of power for system.

.2 Voltage regulated, current limited distributed system power for 100% alarm activation, signal load and full annunciation.

.3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.

.4 Provide DC system with secondary (standby) power source having the following characteristics:

.1 Power supply to interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.2 During normal operating conditions fault in battery charging circuit, a short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.5 Standby batteries to be sealed, maintenance free, sized to power system in accordance with ULC S527 for minimum of 2 hours.

.6 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

.7 Panel to include integral power save circuit to power down system when connected to standby source.

2.7 INITIATIN/INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLA configuration to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Receiving circuits for supervisory, N/O and/or N/C devices. Devices: wired in DCLA configuration to central control unit.

.4 Actuation of an alarm initiating device shall:

.1 Cause an electronic latch to lock in alarm state.

.2 Initiate trouble inhibit circuit to suppress trouble during alarm.

.3 Cause alarm condition for circuit to be logged and processed by Central Processor Unit (CPU) for controlled operation of audible signal appliances and auxiliary control relays.

.4 Flash red zone LED; manual alarm acknowledge will change flashing LED to steady. Subsequent alarm to flash red zone LED for new alarm.

.5 Field wiring of alarm receiving circuits to be supervised for open circuit condition.

.6 Open circuit fault in field wiring of alarm receiving circuit to cause electronic latch to lock in trouble state, log condition at central processor unit, activate common trouble sequence, and illuminate zone trouble indicator.

.7 Ground fault condition in field wiring of alarm receiving circuit to activate common trouble sequence and illuminate system ground fault indicator.

.8 Actuation of NO supervisory device to:

.1 Cause an electronic latch to lock in supervisory "alert" state.

.2 Cause supervisory actuation for that circuit to be logged by central processor unit.

.3 Activate common trouble sequence.

.9 Actuation of an NC supervisory device shall:

.1 Cause an electronic latch to lock in supervisor "alert" state.

.2 Cause supervisory actuation for circuit to be logged by central processor unit.

.3 Activate common trouble sequence.

.10 Field wiring of supervisory receiving circuits to be supervised for open circuit condition.

.11 Open circuit fault in field wiring of supervisory circuit will cause electronic latch to lock in trouble state, log condition at central processor unit, activate common trouble sequence and illuminate system trouble indictor.

.12 Ground fault condition in field wiring of supervisory receiving circuit to activate common trouble sequence and illuminate ground fault indicator.

.13 System initiating circuits to provide subsequent alarm and trouble feature. Subsequent trouble from another circuit will reactivate trouble sequence. Subsequent alarm from another circuit will reactivate alarm sequence.

.14 Do not mix initiating/input circuits between occupancies. Initiating/input circuits are to be connected to each occupancy fire alarm control panel for isolation and control of system testing.

2.8 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class B configuration to central control unit.

.1 Signal circuits' operation to follow system programming; capable of sounding horns in temporal pattern. Each signal circuit: rated at 2 A, 24 VDC; fuse-protected from overloading/overcurrent.

.2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

.3 All output circuits to provide subsequent trouble feature. Subsequent trouble from another circuit will reactivate trouble sequence.

.4 Audio channel available to each speaker circuit to be automatically and dynamically selected by system's microprocessor.

.5 Manual selection and operation of alarm tones to be provided on zone-by-zone basis.

.6 Manual selection for emergency paging to be provided on zone-by-zone basis.

.7 Evacuation control switch to be provided to shunt out automatic system programming once manual control of system has been assumed by authorized personnel.

.2 Do not mix alarm output circuits between occupancies. Alarm output circuits are to be connected to each occupancy fire alarm control panel for isolation and control of system testing.

2.9 AUXILIARY CIRCUITS

.1 System to provide auxiliary contacts for control of functions such as fan control, damper control, door release and elevator capture.

.2 Activation of any selector switches on annunciator from normal position to activate common trouble sequence.

.3 Actual status indication (positive feedback) from controlled device.

.4 Alarm and/or supervisory on system to cause operation of programmed auxiliary output circuits.

.5 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by central control unit.

.6 Two sets of separate contacts for elevator capture (to main floor of egress and to alternate floor of egress).

.7 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.8 Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

2.10 WIRING

.1 Copper conductors.

.2 Initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 Signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 Speaker circuits: twisted, shielded pairs, and in accordance with manufacturer’s requirements.

.5 Control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

.6 Risers: twisted, shielded pairs, 1 hour fire-rated configured to eliminate interference.

2.11 MANUAL ALARM STATION

.1 Addressable manual pull station:

.1 Pull lever, break glass rod, semi-flush wall mounted type, single action, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.

2.12 AUTOMATIC ALARM INITIATING DEVICES

.1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57/88°C, rate of rise 8.3°C per minute. Electronics to communicate detector's status to addressable module/ transponder. Detector address to be set on detector in field.

.2 Addressable Ionization type smoke detector. Electronics to communicate detector's status to addressable module. Detector address to be set in field. Sensitivity settings: 7 settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters. Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.

2.13 AUDIBLE SIGNAL DEVICES AND VISUAL ALARM SIGNAL DEVICES

.1 Horn/Strobes:

.1 Shall be ULC listed to the most recent accepted standard.

.2 Audible component:

.1 Configurable for steady or temporal tone signal and either

.2 Set points at low (94 dBA) or high (98 dBA) output.

.3 When temporal output is selected, self-synchronizing.

.4 Horn Current High Output: 40 mA @ 24 Vdc; 55mA @ 24 Vrms FWR

.5 Low Output: 20 mA @ 24 Vdc; 28 mA @ 24 Vrms FWR

.3 Visual component:

.1 Where more than one strobe is visible in an area, strobes to be synchronized.

.2 Output – candela rating as marked on drawings.

.3 Clear lexan lens with white collar labelled “Fire”. Lens to be properly oriented for wall or ceiling mounting.

.4 Visual signal appliances shall be connected to a dedicated supervised output circuit in the fire alarm control panel.

.5 Wall mounted strobes to have lenses oriented in a vertical direction. Visible from two or three sides.

.6 Ceiling mounted strobes to have lenses oriented in a horizontal direction visible form two or three sides.

.4 Coordinate with electrical auxiliary layout drawings for required candela setting at each strobe.

.5 All horns to be set at low output, adjust set point to high on select units if required based on verification testing results.

2.14 END OF LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.15 REMOTE ANNUNCIATORS

.1 LED type, with designation cards to indicate zones.

.2 Display:

.1 Eight (8) events without scrolling.

.2 Alarms for alarm initiating circuits.

.3 Common supervisory alarm for supervisory initiating circuits.

.4 Common system trouble.

.3 Trouble buzzer.

.1 Acknowledging trouble at main panel to silence trouble buzzers in system.

.4 Supervised, with LED test button and alarm/trouble acknowledge button.

2.16 CABINETS

.1 System control panel to be housed in surface wall mounted cabinet.

.2 All controls, indicators and operating instructions to be clearly visible through viewing window.

.3 Cabinet doors c/w locks to provide access to all operator controls but not expose live electrical connections. Single key for all devices and apparatus.

.4 All electrical connections to be front access through hinged door and removable inner protective cover.

2.17 FIRE ALARM DIALER EQUIPMENT

.1 Honeywell Vista 32FBT – 9 Communicator UL864

.2 Honeywell 6160CR-2 – Commercial Fire Alpha Keypad

.3 Honeywell 7845GSMCN – Digital Cellular Communicator

.4 Honeywell Battery Sense Module (BSM)

.5 Two (2) - 7 AH 12VDC batteries

.6 6 pin telephone single port jack.

.7 GSM ANT 3DB Cellular Antenna

.8 The fire alarm dialer equipment is to be provided as specified. No alternates or equals allowed.

2.18 ELECTRICALLY OPERATED HOLD-OPEN DOOR CLOSERS

.1 Other divisions will supply ULC listed and CSA approved electrically operated hold open door closers. Closer will operate on 24 VDC and is designated in hardware schedule. Time delays will be coordinated with owner and applicable codes.

.2 Closer will operate such that when door holder is energized and door is opened manually, door will be held in open position. On operation of fire alarm system in specific zone in

which door is located, circuit to hold-open device will be interrupted and closer will cause door to close.

.3 Fire alarm system to contain power failure carry-over option such that brief (up to 20 seconds) outage in power supply to each floor fire alarm panel will not cause release of doors. Size on basis of .1 amp at 24 VDC per closer, plus 10% for future.

.4 It shall be possible to manually close door in energized position without adversely affecting closer or indicating on fire alarm system.

2.19 FLOW AND TAMPER SWITCHES

.1 Not required.

3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524.

.2 Install central control unit and connect to ac power supply.

.3 Install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.5 Connect alarm circuits and associated signalling circuits to same control panel.

.6 Install audible signal devices to ULC-S525 and visual signal devices to CAN/ULC-S526 and connect to signalling circuits.

.7 Install end-of-line devices at end of alarm and signalling circuits.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Install remote relay units to control fan shut down and door devices.

.10 Install detectors and make connections to fire smoke dampers.

.11 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.12 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and central control unit, as required by equipment manufacturer.

.13 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.14 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.15 Install Honeywell Vista communicator panel, cellular communicator, keypad and associated equipment.

.16 Mount battery pack and charger in the control cabinet.

.17 Where devices are required to be surface mounted in finished areas, they shall be installed in manufacturer supplied specialty surface boxes, finish painted red in color.

.18 Provide line isolation modules at all locations identified and as required by code.

.19 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.20 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and central control unit, as required by equipment manufacturer.

.21 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.22 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.23 Fire Alarm Dialer Equipment

.1 Install equipment on a plywood backboard in a secure room, and mount between 1000mm and 2000mm above finished floor. Provide 1.0m working clearance in front of all equipment.

.2 Mount keypad to the cover of a RED junction box (185x185x66mm) with a 2-gang plaster ring and provide a 6 pin telephone single port jack within junction box. Box to be labeled indicating phone jack inside.

.3 Mount digital cellular communicator to the cover of a RED junction box (250x250x100mm) using machine screws.

.4 Wire all junction boxes including the Vista 32FB with a tamper alarm. Alarm to sound alarm when the cover is removed, in accordance with CAN/ULC-S537.

.5 Wiring Specifications

.1 Install Cat 6 cable between the fire alarm communication panel and main building telephone demarcation location. Terminate and test cable.

.2 Install 6c#18 FAS cable between the main fire alarm panel and fire alarm communication panel.

.3 All other wiring to be #18 AWG and labelled appropriately. All wiring to be run direct without splice.

.6 All wire to be mechanically protected in conduit. Do not pull into conduit any other wire than fire alarm communication cable. Paint RED all conduit fittings and junction boxes carrying fire alarm monitoring cable.

.24 Vista 32FBT Communicator Panel

.1 Provide 120VAC 15-amp power from a dedicated circuit. Provide power from an emergency power source. Paint the circuit breaker RED to signify it is part of the Fire Alarm system and install a position lock. Provide label on the fire alarm monitoring panel indicating the panel name and circuit number, in accordance with CAN/ULC-S537.

.2 Terminate on the panel as follows:

.1 Power from transformer

.2 Power from transformer

.3 Lead A of 2K resistor provide with package.

.4 Lead B of resistor from terminal 3

.5 Lead A of 2K resistor

.6 Lead B of resistor from terminal 5

.7 Left open.

.8 Left open.

.9 Left open.

.10 Left open.

.11 Positive (red) wire from both 6160CR keypad and 7845GSM Cellular Communicator

.12 Negative (black) wire from both 6160CR keypad and 7845GSM Cellular Communicator

.13 Data In (green) wire from both 6160CR keypad and 7845GSM Cellular Communicator

.14 Data Out (yellow/blue) wire from both 6160CR keypad and 7845GSM Cellular Communicator

.15 Left open.

.16 Left open.

.17 Left open.

.18 Left open.

.19 Left open.

.20 Zone 4 (red) wire from the fire alarm panel for a Normally Open input “Fire Alarm” point

.21 Zone 4 (black) other half of the Normally Open input “Fire Alarm” point

.22 Zone 5 (blue) wire from the fire alarm panel for a Normally Open input “Fire Trouble” Alarm point

.23 Zone 5 (orange) other half of Normally Open input for “Fire Alarm” and Zone 6 (brown) wire from the fire alarm panel for a Normally Open input “Fire Supervisory Alarm”

.24 Zone 6 (green) other half of Normally open input for “Fire Supervisory Alarm”

.25 Left open.

.26 Zone 8 wire from a Normally Closed input “Fire Tamper Alarm” point.

.27 Zone 8 other half of Normally Closed input “Fire Tamper Alarm” point.

.28 Left open.

.29 Left open.

.30 Ground wire provided from transformer case.

.25 BSM and Two (2) 7AH 12VDC batteries

.1 All leads are provided in the package. Do not use the set of leads provided with two wires going to one terminal end.

.2 Terminate as follows:

.1 Positive (red) from battery A to positive post of BSM marked battery A

.2 Negative (black) from battery A to negative of BSM marked battery A

.3 Positive (red) from battery B to positive post of BSM marked battery B

.4 Negative (black) from battery B to negative of BSM marked battery B

.5 Positive post of Vista 32FBT to positive post of BSM marked panel

.6 Negative post of Vista 32FBT to negative post of BSM marked panel

.26 6160 CR Keypad

.1 Supply keypad with 4c#18 FAS cable from Vista 32FBT. Terminate as follows:

.1 Terminal (blue/yellow wire) from terminal 14 of Vista 32FBT

.2 Terminal (red wire) from terminal 11 of Vista 32FBT

.3 Terminal (black wire) from terminal 12 of Vista 32FBT

.4 Terminal (green wire) from terminal 13 of Vista 32FBT

.27 7845GSMCN Cellular Communicator

.1 Supply Cellular Communicator with 4c#18 FAS cable from Vista 32FBT. Terminate as follows:

.1 Terminal 1: Left open

.2 Terminal 2: Red jumper wire to terminal 3

.3 Terminal 3: (Red wire) from terminal 11 of Vista 32FBT

.4 Terminal 4: (Black wire) from terminal 12 of Vista 32FBT

.5 Terminal 5: (Blue/yellow wire) from terminal 14 of Vista 32FBT

.6 Terminal 6: (Green wire) from terminal 13 of Vista 32 FBT

.7 Terminal 7: Left open

.8 Terminal 8: Left open

.28 GSM Antenna

.1 Antenna location to be validated and tested for signal strength prior to installation.

.2 Install as per manufacturer's instructions. Signal strength to be 3 to 5 bars as recommended in installation guide.

.3 No part of the Antenna may be bonded to ground to avoid conflict with the Vista panel.

.29 Fire alarm panel.

.1 Set all alarm point relays as Normally Open with a supervisory 2K resistor placed in parallel with wires coming from Zones of Vista 32FBT. Do not twist or solder resistor to wires coming from Vista32FB, in accordance with CAN/ULC-S537.

.1 Fire Alarm contact: wired to terminals 20 and 21 for Zone 4 from Vista 32FBT.

.2 Fire Trouble contact wired to terminals 22 and 23 for Zone 5 from Vista 32FBT

.3 Fire Supervisory contact: wired to terminal 23 and 24 for Zone 6 from Vista 32FBT.

.30 Dialer Programming and Verification

.1 City requires 14 days notification for creation of monitoring account and programming/commissioning of Dialers. Programming of Dialer must occur prior to Fire Alarm Verification and after the following:

.1 All equipment is installed,

.2 Communication services have been verified as active,

.3 Monitoring Account is active and dedicated phone number assigned.

3.2 PASSIVE GRAPHIC

.1 Provide a total of 3 x passive colour cad graphics, including building outline, corridors and stairwells. Allow for a minimum of 16 colours. All devices on the system shall be assigned to a graphic zone at the time of verification and shall be programmed at the panel to display the graphic zone name as part of the device address. Zone names and boundaries shall be determined by the consultant prior to the FAVI being scheduled. Graphic shall measure 600mm x 900mm and be mounted behind a Plexiglas cover with brushed aluminium frame, where installed outside of FACP tub.

3.3 FIELD QUALITY CONTROL

.1 Perform Tests in accordance with Section 26 08 30 - Testing, Adjusting and Balancing of Electrical Equipment and Systems and CAN/ULC-S537.

.2 All wiring to be installed in conduit.

.3 Fire alarm system:

.1 Test such Device and alarm circuit to ensure manual stations, thermal and Smoke detectors and sprinkler system transmit alarm to control panel and actuate first stage alarm.

.2 Check annunciator panels and passive graphic to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more Subsequent alarm signals on each side of single open-circuit fault Condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of 3 Signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of 3 signals. Correct imposed fault after completion of each Series of tests.

.5 Provide final PROM program update for System incorporating program changes made during construction.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Supply and install chain link fencing, complete with [swing][sliding] gates, as indicated in this Section.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturer and tradesmen executing the work of this Section shall have had a minimum 5 years continuous Canadian experience in successful manufacture and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

.2 Erection of chain link fencing and gates shall be by workers especially trained and experienced in this type of work. Have a senior, qualified representative at the job site to direct the work of this Section at all times.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Submit fully dimensional shop drawings to Consultant showing construction, assembly, elevations, sections and interfacing with work of other Sections.

.2 No work of this Section shall be fabricated until shop drawings and all other related submittals, documentation, certifications and samples as required by this Section, have been reviewed by Consultant.

.3 Details shall indicate metal thicknesses, fasteners and welds, all anchorage assemblies and components and erection details.

.2 Samples:

.1 Submit to Consultant for approval, samples of materials and components to be used in the systems, prior to fabrication of work together with name of manufacturer and technical literature. Submit 300 mm x 300 mm samples of chain link fence fabric in colour as selected by the Consultant.

2 Products

2.1 APPROVED MANUFACTURERS

.1 Subject to compliance with specifications, use products of one of the following:

.1 McGowan Fence and Supply Ltd., or;

.2 Lundy Fence, Division of IVACO Inc., or;

.3 Peel Fence Systems Inc., or;

.4 Approved equal.

2.2 MATERIALS

.1 Steel Pipe: Conforming to CAN/CGSB-138.2.

.2 Fabric: No.9 gauge nominal ultra violet light resistant, P.V.C. coated, galvanized steel wire in 2" mesh, with both top and bottom selvages twisted and barbed, conforming to CAN/CGSB-138.1-M80.

.3 End, Corner, and Pull Posts: Galvanized steel, minimum sizes and weights as follows;

.1 Up to 1830 mm Fabric Height: 63 mm outside diameter pipe, 0.5 kg/m.

.2 Over 1830 mm Fabric Height: 73 mm outside diameter pipe, 0.8 kg/m.

.4 Line Posts: Galvanized steel, minimum sizes and weights as follows;

.1 Up to 1830 mm Fabric Height: 48 mm outside diameter pipe, 0.4 kg/m.

.2 Over 1830 mm to 2440 mm Fabric Height: 63 mm outside diameter pipe, 0.5 kg/m .

.3 Over 2440 mm Fabric Height: 73 mm outside diameter pipe, 0.8 kg/m.

.5 Gate Posts: Galvanized steel, for single gate or double leaf gate as follows;

.1 Up to 1830 mm Fabric Height: 73 mm outside pipe diameter, 0.8 kg/m.

.2 Over 1830 mm Fabric Height: 100 mm outside diameter pipe, 1.3 kg/m.

.6 Top Rail and Intermediate Rails: Galvanized steel, manufacturer's longest lengths as follows:

.1 Typical: 42 mm outside diameter pipe, 0.3 kg/m.

.2 Couplings: Expansion type, approximately 150 mm long.

.3 Attaching Devices: Means of attaching top rail securely to each gate, corner, pull, and end post.

.7 Sleeves: Galvanized steel pipe with inside diameter not less than 13 mm greater than outside diameter of pipe. Provide steel plate closure welded to bottom of sleeves of width and length not less than 25 mm greater than outside diameter of sleeve as follows;

.1 Up to 1830 mm Fabric Height: Provide sleeve not less than 305 mm long.

.2 Over 1830 mm Fabric Height: Provide sleeve not less than 610 mm long.

.8 Tension Wire: Minimum No.7 gauge galvanized steel, coated coil spring wire, located at bottom of fence fabric.

.9 Wire Ties: Minimum No.11 gauge galvanized steel.

.10 Post Brace Assembly: Manufacturer's standard adjustable brace at end posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same materials as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

.11 Post Tops: Galvanized steel, weather tight closure cap for tubular posts, one cap for each post. Furnish cap with openings to permit passage of top rail.

.12 Stretcher Bars: Galvanized steel, one piece lengths equal to full height of fabrics with minimum cross section of 4.75 mm x 19 mm. Provide one stretcher bar for each gate and end post, and two for each corner and pull post.

.13 Stretcher Bar Bands: Manufacturer's standard.

.14 Gate Hardware:

.1 Swinging Gate Hardware:

.1 Hinges: Offset type hinges to permit 180° gate opening. Provide 1-1/2 pair of hinges for each gate leaf over 1830 mm height.

.2 Latches: Forked or plunger bar type to permit operation from both sides of gate, with padlock eye.

.2 Double Leaf Gate Hardware:

.1 As specified herein for swinging gate hardware and in addition provide "mushroom" type flush plate gate stops with anchors set in concrete to engage centre drops rod/plunger bar. Arrange stops for use with one padlock to lock both gate leaves.

.3 Cantilever Sliding Gate Hardware:

.1 Gate Frame: 63 mm diameter frame with same material as posts

.2 Manufacturer's standard heavy-duty roller attached at top and bottom for each post to hold gate frame, allow gate sliding across between the top and bottom rollers. Provide the amount of rollers as required to hold the width and weight of the gate.

.15 Gate Cross-Bracing: 10 mm diameter galvanized steel adjustable length truss rods.

2.3 SETTING GROUT

.1 Concrete: Minimum 20 MPa. Refer to Section 03 30 00 – Cast-in-Place Concrete.

.2 Grout: Premixed, factory-packaged, non-staining, non-corrosive grout. Refer to Section 03 30 00 – Cast-in-Place Concrete. Provide type especially formulated for exterior application.

2.4 FINISHES

.1 Galvanize as follows:

.1 Fabric: Not less than 1.2 oz zinc/sq ft.

.2 Framing: Not less than 1.8 oz zinc/sq ft.

.2 P.V.C. Coating:

.1 Ultra violet light resistant, polyvinyl chloride (PVC) coating shall be applied by field bed method to preheated substrate, to 10 to 14 mils dry film thickness (DFT) on pipe and 7 to 10 mils dry film thickness (DFT) on fence fabric.

.2 Clean and pretreat surfaces as required to thermally bond the P.V.C. coating to surfaces.

.3 Colour shall be as selected later by Consultant from manufacturer's full available colour range.

2.5 FABRICATION

.1 Fabricate swing gate perimeter frames of 48 mm outside diameter galvanized steel pipe. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Gates shall conform to CAN/CGSB-138.4-M82. Space frame members maximum 2440 mm apart.

.2 Assemble gate frames rigidly by welding or with special fittings and rivets. Use same fabric as specified for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to frame at 305 mm O.C. Install diagonal cross-bracing on gates as required to ensure frame rigidity without sag or twist.

.3 Attach hardware to provide security against removal or breakage.

.4 Fabricate swing gates, double gates and sliding gates as indicated on drawings.

3 Execution

3.1 INSTALLATION

.1 Install chain link fencing in strict accordance with CAN/CGSB-138.3 and as specified herein.

.2 Space line posts at 3050 mm O.C. maximum.

.3 Methods for Setting Posts:

.1 Grade-Set Posts: Drill holes for post with auger or hand excavate. Excavate each post hole to minimum 305 mm diameter, or not less than 4 times the post diameter. Excavate to 100 mm below bottom of post. Set bottoms of posts 150 mm below "frost line". Hold, brace posts plumb, level while placing, consolidating and finishing concrete.

.2 Sleeve-Set Posts In Concrete: Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. Insert posts into sleeves and fill annular space between post and sleeve solid with grout. Mix and place grout in accordance with manufacturer's written instructions.

.4 Intermediate Rails: Provide centre rails where indicated. Install in one piece between posts and flush with post on fabric side, using offset fittings where necessary.

.5 Brace Assemblies: Install braces so posts are plumb with rod in tension.

.6 Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with minimum No.6 gauge galvanized wire. Fasten fabric to tension wire using No.11 gauge galvanized steel hog rings at 610 mm O.C.

.7 Fabric: Leave approximately 50 mm between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so fabric remains in tension after pulling force is released.

.8 Stretcher Bars: To secure end, and pull posts, thread through or clamp to fabric 100 mm O.C. and secure to posts with metal bands spaced on 305 mm O.C.

.9 Tie Wires:

.1 Use U-shaped wire conforming with diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted two full turns. Bend wire ends to minimize hazards to persons or clothing.

.2 Tie fabric to line posts with wire ties spaced 305 mm O.C. Tie fabric to rails and braces with wire ties spaced 610 mm O.C. Manufacturer's standard procedure will be accepted if of equal strength and durability.

.10 Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

.11 Install swing gates, double gates and sliding gates plumb, level and secure for full openings, without interference. Set all ground set hardware in concrete for secure anchorage. Adjust and lubricate all gate hardware for smooth and efficient operation.

END OF SECTION