DIVISION 1

GENERAL REQUIREMENTS

SECTION 01000
GENERAL REQUIREMENTS

SECTION 01000
GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INTENT

.1 The intent of this section is to cover the General Instructions and Requirements for the Field Office, Bond, Warranty, Insurance, Regulations, Substantial Performance, Standards and Maintenance Security, and other general requirements governing this Contract.

1.2 GENERAL INSTRUCTIONS

.1 The Contractor is responsible for the layout elevations, alignment of the work, and verification of all measurements and details of the existing structures and utilities and the surrounding areas necessary for the proper setting out, fitting, connection, and completion of the intended works described in Section 01010 – Summary of Work and as described in the Contract Drawings. Refer any discrepancies between the drawings and the existing works to the Engineer before commencing the affected works.

.2 Be responsible for the proper fitting of the work and make such changes as necessary and as directed by the Engineer without additional cost to the Township of Minden Hills.

.3 Restrict all operations such as construction and storage within the limits of the area designated by the Township of Minden Hills..

.4 Maintain safe access to any existing facility for the Township of Minden Hills's Operation staff at all times during the entire construction period.

1.3 WARRANTIES

.1 The supplementary General Conditions and Special Provisions define contract warranty and conditions.

1.4 BONDS

.1 The Contractor shall provide a 100% Performance Bond, a 100% Labor and Material Payment Bond, and Liability Insurance, all based on the Contract Price, as outlined in the Information for Tenderers and General Conditions.

.2 Provide all major sub-contractors bond in accordance with the Information for Tenderers.

1.5 SITE-SPECIFIC HEALTH AND SAFETY

.1 The Contractor shall submit a Site-Specific Health and Safety Plan within five (5) working days after the date of Notice to Proceed and before mobilization on-site. The site-specific Health and Safety plan must address the requirements of the Acts.

.2 The Contractor shall meet the requirements of the following:

.1 Occupational Health and Safety Act, Regulations for Construction Projects, O. Reg 213/91, latest edition.

.2 Occupational Health and Safety Act, Regulations for Industrial Establishments Regulations, O. Reg 851, latest edition.

.3 Occupational Health and Safety Act, Regulation for Confined Spaces, O. Reg 632/05, latest edition.

.4 Occupational Health and Safety Act, Regulations for Designated Substances, O. Reg 278/05, latest edition.

.3 Conform with current Occupational Health and Safety Act and Regulations and any or all other Acts and Bylaws enforced to ensure the safety of all workers and others engaged on the site at all times.

.4 The Contractor shall be in strict conformance with all regulations enacted by the Federal and Provincial Governments in conjunction with the Workplace Hazardous Materials Information System (WHMIS) and Materials Safety Data Sheet (MSDS).

1.6 GEOTECHNICAL INVESTIGATION

.1 Geotechnical information is based on the Technical Memorandum re: Geotechnical Consulting Services – Scotch Line Transfer Station dated on June 15, 2023 prepared and assembled by WSP Canada Inc. (WSP). A copy of the report has been provided on the additional Contract Documents.

.2 It is to be clearly understood that the information was accumulated for design purposes only and any interpretation placed on it by the Contractor is solely the responsibility of the contractor.

.3 The Township of Minden Hills accepts no responsibility for the accuracy of the borehole information. Claims arising from the interpretation of available information will not be considered.

1.7 MAINTENANCE AND SECURITY

.1 Refer to the General Conditions of the Contract for requirements of Maintenance and Security.

1.8 SUBSTANTIAL PERFORMANCE

.1 Before the Township of Minden Hills takes over the works from the Contractor or issues the Certificate of Substantial Performance, the provisions for Performance Testing set out in Section 01605 - Equipment and System Performance and Operational Testing and the provisions set out in Section 01820 - Training and the provisions set out in Section 01780 - Closeout Submittals shall be completed satisfactorily and all certificates from equipment suppliers stating that their equipment has been satisfactorily installed, tested and is in proper working order shall have been received by the Township of Minden Hills.

.2 The date of Substantial Performance as shown on the Certificate of Substantial Performance will be the date of satisfactory completion of Initial Operation or Performance Testing, whichever is later, or a date thereafter, providing all applicable requirements in the General Conditions and the Supplementary Conditions are satisfied. In the event of any conflicts between the Specifications and the Supplementary Conditions, the Supplementary Conditions shall govern.

1.9 NATURE OF SITE

.1 The Contractor shall make a careful examination of the Site and shall take all such steps that are necessary to ascertain the conditions under which the Work is to be carried out. No extra money shall be payable to the Contractor due to soil, subsoil conditions, and/or groundwater conditions adversely affecting the Contractor's work or any other matter affected by the characteristics of the Site.

.2 The Contractor, at the time of tendering, shall conduct such investigations concerning subsurface ground and groundwater conditions as deemed necessary to become informed of the subsurface ground and groundwater conditions that will be encountered during construction.

.3 The Contractor shall provide extra measures and maintain additional precautions to comply with the Hydro safety policies and requirements working near overhead lines at no additional cost to the Township of Minden Hills.

.4 No vehicles such as pickup trucks, delivery trucks, excavators, etc., or storage of materials shall be allowed at any time under and within the boundary of existing overhead lines prescribed in the Hydro safety manual for working near overhead lines.

1.10 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

.1 Dimensions on drawings when marked by lines and arrow points, take precedence over measurements by scale.

.2 In case of discrepancy between the drawings and specifications, figure dimensions on the drawings govern, except where the dimension depends on the dimension of a specified product, in which case the dimensions of the product

govern. In the case of discrepancy in the description of materials and methods, the specifications govern.

.3 Refer all cases of discrepancy to the Engineer who will give his decision in writing. The decision will be consistent with the evident meaning and intention of the drawings and specifications.

1.11 REGULATING REQUIREMENT

.1 Conform construction methods, equipment, and all operations with the applicable Ontario regulations and amendments made under The Department of Labour Act, The Mining Act, The Construction Safety Act, and any or all other Acts and By-laws in force to ensure the safety of the works and the Contractor's workmen and others at all times.

.2 The Township of Minden Hills will provide a clean set of Contract Drawings and Specifications for each application.

.3 Be responsible for arranging for all regular inspections by authorities having jurisdiction and all final inspections required.

1.12 DAMAGE TO EXISTING UTILITIES AND STRUCTURES

.1 The access to the site is from Scotch Line Road. Maintain this road in its original condition during construction. Rectify any adverse impact or damage by the Contractor’s vehicles or operations immediately, without any cost to the Township of Minden Hills.

.2 Be responsible for adequately protecting any public or private service or utility adjacent to the work.

.3 Obtain necessary drawings and perform any necessary sub-surface investigations to determine the exact number and location of all existing utility services, structures, underground pipes, cables, utilities, and other similar items.

.4 The location for existing pipes, cables, and other similar items as shown on the contract drawings do not relieve the Contractor of his responsibility to identify and protect underground pipes and services.

.5 If any damage is caused to existing utilities and structures, repair and make good such damage at no additional cost within a reasonable time and to the satisfaction of the Township of Minden Hills and Engineer.

1.13 OCCUPYING THE SITE

.1 Use only those areas designated by the Township of Minden Hills for the access, except in so far as is necessary for the execution of the Work, and in so doing, do not unnecessarily obstruct the normal traffic of, to, from, or about the Site; and do

not unreasonably allow any vehicles or materials to stand in front of, or near to, any buildings on the Site or any access thereto.

.2 Areas shown as construction limits are areas to be used by the Contractor for construction, storage, access, and temporary facilities.

.3 Confine operations within areas designated for construction, storage, and access as shown on the Contract Drawings and/or as directed by the Township of Minden Hills.

.4 Make arrangements with the Township of Minden Hills if additional areas are required for the storage of construction materials.

1.14 SITE ADMINISTRATION

.1 At all times during the course of the work, the Contractor is to provide the following:

.1 Leave the site in a clean and sanitary condition after completion of the Works.

.2 Provide and maintain in a clean orderly condition: completely equipped first aid facilities on site which must be always readily accessible to all employees.

.3 Designate certain employees who are properly instructed to be in charge of first aid. At least one such employee must always be available on the site while work is being carried on.

.4 A telephone call list for summoning aid, such as doctors, ambulances, and rescue squads from outside sources is to be conspicuously posted.

1.15 COORDINATION OF THE WORK

.1 Be responsible for the coordination of the work of all trades to the end of the combined work and produce a first-class result, without delays.

.2 Expedite the ordering of all materials and equipment required. No claim is allowed for delay of additional expenses resulting from failure to place an order in ample time.

.3 Provide the Director, Construction Safety Branch of the Ministry of Labour, with the information required under Section 5 of Ontario Regulation 213 before commencing work.

.4 The Contractor shall submit a construction schedule within five (5) working days after the date of Notice to Process. The construction schedule will be reviewed by the Township of Minden Hills to ensure that the work by the contractor will not

interfere with the City's operations or work by other parties. The contractor shall modify the construction schedule upon agreement of all parties.

.5 In all instances, the operation of the Scoth Line Landfill Site by the Township of Minden Hills shall take priority over the work of the contractor including but not limited to scheduling of work, lay down areas, and access to the work area.

1.16 CONTRACTORS SITE PARKING

.1 All vehicles belonging to the Contractor, his staff, sub-trades, or suppliers are to be parked within the designated parking area. The Township of Minden Hills will identify these areas upon contract award.

1.17 PROJECT MEETINGS

.1 The Engineer upon award of the Contract may arrange a preconstruction meeting. A senior Contractor representative and the designated superintendent must attend.

.2 Attend job progress meetings as required by the Engineer.

1.18 PROGRESS MEETINGS

.1 Attend progress meetings as required by the Engineer and the Township of Minden Hills.

.2 The meeting may be generally held at the beginning of the project but may be more frequent to ensure adherence to schedule and when the project is close to commissioning.

.3 Be responsible for ensuring attendance by the Contractor's project manager.

.4 Before the meeting, inform the Engineer about any other items which should be added to the agenda.

1.19 SUBCONTRACTOR COORDINATION MEETINGS

.1 Subcontractor coordination meetings will be organized by the Engineer as required to reinforce the contract requirements.

.2 When required, the Engineer may convene a pre-installation meeting.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01001
REFERENCES

SECTION 01001
REFERENCES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 AA – Aluminum Association

.2 AASHTO – American Association of State Highway and Transportation Officials

.3 ACI – American Concrete Institute

.4 AIEE – American Institute of Electrical Engineers

.5 AISI – American Iron and Steel Institute

.6 AITC – American Institute of Timber Construction

.7 AMCA – Air Movement and Control Association Inc.

.8 ANSI – American National Standards Institute

.9 API – American Petroleum Institute

.10 ARI – Air Conditioning and Refrigeration Institute

.11 ASHRAE – American Society of Heating, Refrigeration and Air-Conditioning Engineers

.12 ASME – American Society of Mechanical Engineers

.13 ASTM – American Society for Testing and Materials

.14 AWCI – Association of the Wall and Ceiling Industries

.15 AWMAC – Architectural Woodwork Manufacturers Association of Canada

.16 AWS – American Welding Society

.17 AWWA – American Water Works Association

.18 CEC – Canadian Electric Code

.19 CEMA – Canadian Electrical Manufacturer’s Association

.20 CESA – Canadian Engineering Standards Association

.21 CGA – Canadian Gas Association

.22 CGSB – Canadian General Standards Board

.23 CISC – Canadian Institute of Steel Construction

.24 CITC – Canadian Institute of Timber Construction

.25 CMB – Construction Materials Board

.26 CRCA – Canadian Roofing Contractors Association

.27 CSA – Canadian Standards Association

.28 CSC – Construction Specifications Canada

.29 CSDFMA – Canadian Steel Door and Frame Manufacturing Association

.30 CSPI – Corrugated Steel Pipe Institute

.31 CSSBI – Canadian Sheet Steel Building Institute

.32 CWC – Canadian Wood Council

.33 EEMAC – Electrical and Electronic Manufacturers' Association of Canada

.34 FCC – Fire Commissioner of Canada

.35 HEPC – Hydro Electric Power Commission

.36 ICPI – Interlocking Concrete Pavement Institute

.37 IEEE – Institute of Electrical and Electronics Engineers

.38 IFI – International Fasteners Institute

.39 ISA – Instrument Society of America

.40 MNR – Ministry of Natural Resources

.41 MTO - Ministry of Transportation Ontario

.42 MOE – Ministry of the Environment

.43 MSS – Manufacturers Standardization Society of the Valve and Fittings Industry

.44 NAAMM – National Association of Architectural Metal Manufacturers

.45 NACE – National Association of Corrosion Engineers

.46 NBC –National Building Code

.47 NFC – National Fire Code

.48 NEMA – National Electrical Manufacturers Association

.49 NFPA – National Fire Protection Association

.50 NFSA – National Fire Sprinkler Association

.51 NRC – National Research Council

.52 OESC – Ontario Electrical Safety Code

.53 OPSD – Ontario Provincial Standard Drawings

.54 OPSS – Ontario Provincial Standard Specifications

.55 PCI – Prestressed Concrete Institute

.56 SCC – Standards Council of Canada

.57 SMACNA – Sheet Metal and Air Conditioning Contractors' National Association

.58 SSPC – Steel Structures Painting Council

.59 TTMAC – Terrazzo, Tile and Marble Association of Canada

.60 UL – Underwriters' Laboratories

.61 ULC – Underwriters' Laboratories of Canada

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01010
SUMMARY OF WORK

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines in general the work to be completed under the Contract, the sequence of work, the Contractor's use of the site, and the Contract Documents.

.2 The Contractor shall supply new equipment and materials as specified herein and provide quality labor, equipment, materials, tools, supervision, and other services as required for executing the works.

.3 Organize and coordinate with all regulatory agencies. All costs resulting from this requirement are to be paid by the Contractor.

.4 Construct and test as required by the codes and standards for all foundations, structures, concrete ramps, curbs, pavement, roads, and other facilities shown on the drawings and specified herein.

.5 Supervise, organize, coordinate, and direct all construction operations of sub-trades and suppliers.

.6 Provide, install, and put in operation all equipment and appurtenances. Provide operating manuals, training, and assistance to the Township of Minden Hills.

.7 If anything in these contract documents interferes with the realization and intent of the Project, or does not comply with applicable codes and regulations, the Contractor shall inform the Township of Minden Hills and the Engineer immediately in writing.

.8 In addition to constructing the works shown on the drawings, design, construct, and maintain, unless otherwise specified or shown on the drawings, all temporary works and facilities are required for the construction of the works. Remove temporary works and facilities when construction is completed. Temporary works and facilities include but are not limited to the following:

1. Shoring systems.

2. Excavation dewatering systems (if required).

3. Formwork for concrete.

4. Falsework and bracing for formwork or other parts of the works while under construction.

5. Bracing and shoring for partially completed works or other assembly.

6. Scaffolding.

1.2 SUMMARY OF WORK

.1 The work in this contract consists of the construction of one new scale house (referred in Contractual Documents by Kiosk) with two new weigh scales at the Scotch Line Landfill Site, but not necessarily be limited to the following:

1. Site preparation including clearing, grubbing, tree and topsoil removal.

2. Earthwork to prepare subgrade for proposed works. Rock excavation as/if required (provisional item).

3. Granular B surface for transfer station and access roads.

4. Supply and install concrete blocks for elevated drop off area. Install guardrails at the elevate drop off area as shown on the drawings.

5. Construction of one prefabricated scale house (Kiosk), deck at entrance of scale house with wooden ramp and stair with safety guard railing as shown and specified on the proposed site plan and relevant architectural and structural drawings. Construction of all superstructures and substructures shall be in accordance with construction drawings and specifications.

6. Construction of four (2) reinforced concrete approach slabs, and curbs as shown and specified on the proposed site plan and relevant structural drawings.

7. Procurement, installation, and testing of two (2) new 11-foot-wide x 80-foot-long weigh scales with 100 tons capacity. The Contractor is responsible for the complete construction of the scale system including foundations, installation, concrete topping, and calibration. The Contractor is to coordinate with the Township of Minden Hills and the Scale Vendor's drawings for the accuracy of all measurements, dimensions, and elevations of concrete foundations and offset/clearances required between concrete foundations and the scales before construction. The construction of reinforced concrete foundations shall include the following:

.1 Coordinate with the Township of Minden Hills and their scale vendor for the accuracy of foundation elevations and other measurements.

.2 Provide shop drawings for the reinforced concrete foundations for the new 80-foot weigh scale system.

.3 Excavate the area specified for the location of new 80-foot weigh scales as shown on the drawings.

.4 Supply and install reinforced concrete for the foundations and approach and exit slabs as per the approved shop drawings.

.5 Cure the concrete and complete backfill works.

.6 Submit concrete test results. Ensure Concrete has achieved the required strength before the installation of Scales by Others.

.7 Restore the existing disturbed pavement areas.

.8 An access lane shall be provided to the city to keep the facility operational at all times.

8. Electrical scope of the project shall include, but not be limited to, the following:

.1 Procurement, installation, and commissioning of Light fixtures, Indoor 120V receptacles, Main fused disconnect switch, Meter base, all cabling and conduits, Lighting panel, Meter base, all cabling and conduits, Outdoor light poles, Grounding.

.2 Construction of cable trenches and the associated works (as shown on the approved drawings and relevant specifications.)

.3 Submit P.Eng. stamped shop drawings for all electrical submissions.

.4 All Electrical equipment, installations, and commissioning shall be in conformance to OESC and other Electrical codes referred to in Electrical specifications.

.5 Contractor shall submit ESA inspection reports for all electrical installations.

.6 Contractor shall submit field test reports for electrical equipment and cables.

.7 All electrical works shall be carried out as per approved drawings and specifications.

9. Installation of heat pump air conditioning unit and ne and envelope electric baseboard heaters complete with all required accessories. All these works shall be carried out as per the approved drawings and project specifications. The contractor shall submit shop drawings for the Engineer’s review for HVAC including equipment, and all associated accessories.

1.3 WORK SEQUENCE

.1 The work should be carried out in a logical sequence to keep the landfill fully operational during construction, and to the approved construction progress documentation Section 01015 - Construction Sequencing.

.2 The Contractor shall schedule their works in accordance with the standard construction time frame and sequence required to complete the works and must submit to the Township of Minden Hills /Engineer for review and approval as specified.

.3 The Contractor will notify the Township of Minden Hills at least ten (10) working days before commencing work.

1.4 CONTRACT DOCUMENTS

.1 One copy of the Contract Drawings and Specifications will be furnished by the Township of Minden Hills. Any additional sets will be made by the Contractor at their expense.

.2 Maintain at the job site at least one copy of the following documents:

1. Contract Drawings.
2. Specifications.
3. Addenda (if any).
4. Reviewed Shop Drawings.
5. Change Orders (if any).
6. Field test reports.
7. Copy of approved works schedule.
8. Manufacturer’s installation and application instructions.
9. Approvals and Permits.

1.5 CONTRACT DRAWINGS

.1 Contract Drawings form part of Contract Documents.

.2 Additional drawings and Shop Drawings signed/sealed by a Professional Engineer of Ontario showing details in accordance with which work is to be constructed will become part of Contract Documents.

.3 The location of utilities shown on Contract Drawings is in accordance with the best information available and is not guaranteed.

.4 The Specifications must be read in conjunction with the drawings to obtain exact details of the work to be done. No claims resulting from the failure to do so will be entertained.

.5 The Contractor shall be governed by figured dimensions, as given on the Drawings. Where required dimensions are not shown in figures, immediately inform the Township of Minden Hills /Engineer before proceeding with the construction of the portion of the work to which they refer.

PART 2 PRODUCTS

2.1 WEIGH SCALES

.1 Weigh scales shall be Survivor OTR Concrete Deck Truck Scale, manufactured by Rice Lakes Weighing Systems, or

.2 Approved equivalent.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015
CONSTRUCTION SEQUENCING

SECTION 01015
CONSTRUCTION SEQUENCING

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section includes mandatory construction sequencing constraints and a suggested sequence of construction that will satisfy the mandatory constraints required in the execution of the Work regulations, standards, and considerations governing this Contract.

.2 The suggested sequence of construction described herein is general in nature and outlines the intent of the design with respect to the implementation and general progress of the Work. The descriptions of construction activities as outlined in this Section are not intended to be comprehensive or all-inclusive. Many other construction activities and Work components, although not specifically noted in this Section, are integral parts of the Work and shall be scheduled and completed by the Contractor in accordance with the Contract Documents.

.3 The broad grouping of parts of the Work under phases, stages, or similar divisions in the suggested sequence of construction is intended to illustrate the general sequence for execution of the Work as envisioned by the Engineer. Such grouping shall in no way relieve the Contractor of complete and sole responsibility for the construction means, methods, techniques, sequences, and procedures of construction, or the safety precautions and programs incidental thereto.

1.2 RELATED SECTIONS

.1 Section 01010 - Summary of Work

.2 Section 01300 - Submittals

.3 Section 01450 - Quality Control

.4 Section 01535 – Temporary Facilities

1.3 SUBMITTALS

.1 The Contractor shall provide a proposed sequence of construction no later than five Working Days prior to the preconstruction meeting.

.2 Submittals to conform with Section 01300 – Submittals.

1.4 SERVICES PROVIDED BY THE CONTRACTOR

.1 The Contractor shall provide all required temporary construction roads, drainage, grading, sedimentation, and erosion control measures for the construction area.

.2 The Contractor shall provide all necessary temporary power, pumping facilities, ventilation equipment, pipes, valves, fittings, equipment and material storage, diversions, temporary bulkheads, or any other equipment and systems, as required during construction.

.3 The Contractor shall meet all requirements of Section 01535 – Temporary Facilities.

1.5 ISOLATION OF EXISTING FACILITIES

.1 Where the Contract Documents indicate modifications, demolition, relocation, and/or connections to existing cables, conduits, electrical panels, and local control panels, it shall be the Contractor's responsibility to isolate and disconnect the equipment such after agreeing upon appropriate procedures and isolation points with the Owner (Township of Minden Hills).

.2 Any other additional temporary isolation and/or shut-down, if considered necessary by the Contractor, shall be done at the sole discretion of the Contractor to suit the specified construction requirements and to protect the health and safety of construction personnel.

1.6 MONITORING AND EMERGENCY RESPONSE

.1 The Contractor shall have the necessary resources, materials, personnel, and equipment readily available to provide continuous 24 hours per calendar day, seven calendar days per week monitoring and emergency repair of sheeting, shoring, and other such temporary systems that are used to execute the works.

1.7 ELECTRICAL AND TEMPORARY POWER

.1 Where electrical power is not available, provide temporary power in the form of portable generators at no additional cost to the Owner.

1.8 FIRE PROTECTION

.1 Provide adequate supplementary fire protection facilities including, but not limited to, ample hand-operated 7 kg to 15 kg multipurpose dry chemical extinguishers. Provide temporary hose lines in areas where construction is in progress until the permanent fire protection is placed into service. Do not block hydrant hose connections and other firefighting equipment with construction equipment and always make it readily accessible.

.2 Dispose of all combustible rubbish promptly and safely. Prompt disposal is particularly needed for material that may be subject to spontaneous ignition such as oily waste and paint rags.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL SUGGESTED SEQUENCE OF CONSTRUCTION

.1 The suggested sequence of construction described herein is based on the Engineer's knowledge of the design components of the Project. The Engineer and the Owner assume no responsibility for the time required to construct the Work following the suggested sequence of construction described herein.

.2 The Work is to be completed within the Contract Time stated in the Form of Tender and in accordance with the described Contract Milestones. In this regard, the Contractor is solely responsible for construction means, methods, techniques, procedures, scheduling, coordinating, and sequencing of the Work.

.3 The Contractor may on its initiative, submit an alternate proposed sequence of construction to the Engineer for review. Such review shall not make the Engineer responsible for the time or costs required to construct the Work following the Contractor's alternate sequence of construction.

.4 Incorporate the construction constraints and sequence of construction in the Progress Schedules.

.5 The suggested sequence of construction describes in general the sequence of construction in stages.

.6 The general suggested sequence of construction is as follows:

.1 Develop and submit construction schedule.

.2 Develop Health and Safety plans and submit the plans.

.3 Site Mobilization – offices, fencing, Site security, temporary utilities, obtaining all permits, preconstruction surveys, etc.

.4 Put in place tree protection fence, erosion control silt fencing, and other measures prior to stripping the Site and any earthworks operations.

.5 Put in place mud and dust control measures and other environmental protection measures.

.6 Excavation and earthworks – dewatering, excavation, grading, layout, etc. to prepare the site for new construction works.

.7 Construction/installation of new items identified on the drawing.

.7 The Contractor shall generally perform the Work according to the suggested sequence of construction provided in Section 01015 – Construction Sequencing and within the construction constraints provided in this Section to ensure completion of the Work within the Contract Time and in a safe manner. Completion dates of the various stages shall be in accordance with the accepted construction schedule submitted by the Contractor.

.8 To assist the Contractor in developing the sequence of work, refer to the Contract Drawings.

.9 In addition to the mandatory constraints described herein, the following information on the Work to be undertaken is provided to assist the Contractor in developing a sequence of Work.

.10 The information presented below is not, nor is it intended to be, complete and all-inclusive. Work may proceed concurrently or separately in each area and may need to be adjusted to suit plant process timing restrictions, seasonal conditions, and equipment delivery restrictions. Work may proceed independently in each area but is subject to the mandatory constraints mentioned in the General Note on the drawing.

3.2 SUGGESTED SEQUENCE OF CONSTRUCTION FOR PROJECT MILESTONES

.1 The clauses, guidelines, and constraints described in subsection 3.2 General Suggested Sequence of Construction, apply to this subsection. The Contractor shall still be solely responsible for construction means, methods, techniques, procedures, scheduling, coordinating, and sequencing of the Work.

.2 The following is a suggested sequence of construction based on the Summary of Work in Section 01010 and the Contract Drawings:

.1 Conduct a pre-condition survey of the work areas.

.1 Take extensive photographs of the work areas and submit to the Engineer before performing any work.

.2 Perform a topographic survey of the work areas and submit to the Engineer before performing any work.

.2 Conduct utility locates and subsurface investigation and report the results to the Engineer.

.3 Provide silt fence and site construction fence.

.4 Provide temporary tree protection fence.

.5 Provide shop drawings signed and stamped by a P.Eng. for the following:

.1 Weigh Scale system for 80-feet inbound scale and outbound scale.

.2 Foundation and support system for all auxiliary systems such as CCTV cameras, ticket printers, weight gauges and traffic arms, Light Poles etc.

.3 Electrical line diagram and associated connection, electrical pole, cables, lighting fixtures and accessories, and equipment.

.4 HVAC duct and equipment including cold potable water and sanitary system.

.6 Carry out necessary earthworks and construct new reinforced concrete ramps including curbs for new weigh scales.

.7 Carry out necessary earthworks and construct scale houses, decks, and ramps.

.1 Excavate up to the required depth and carry out necessary earthworks for the scale house foundation. The base of the foundation area shall be tested for a minimum of 98% SPDD

.2 Provide formworks and install reinforcement and anchor bolts for the foundations for scale houses and decks. Supply and install concrete for the foundations.

.3 Supply and install pipes, and conduits for the plumbing, sanitary, electrical, and instrumentation works prior to backfill at and around the scale house foundations.

.4 Complete backfill works at and around the scale house foundations and deck foundations up to the required elevation. Cure the foundations.

.5 Construct scale house, deck, and steps.

.6 Construct safety handrailing.

.7 Provide all electrical lighting, HVAC, plumbing and instrumentation for the scale house.

.8 Carry out necessary earthworks and construct access truck laneway.

.1 Identify and provide protection to existing utilities (for underground above-ground).

.2 Excavate and remove landscaped median and garden soil up to the required depth.

.3 Carry out necessary earthworks for subgrade up to the required elevation in layers (maximum 200mm). Each subgrade layer shall

be tested for a minimum 98% Standard Proctor Dry Density (SPDD).

.4 Supply and install subbase material up to the required elevation. The subbase layer shall be tested to a minimum of 100% SPDD.

.5 Excavate up to the required depth and carry out necessary earthworks for the outbound scale. The base of the foundation area shall be tested for a minimum of 98% SPDD.

.6 Provide formworks and install reinforcement and anchor bolts for the foundations. Supply and install concrete for the foundations.

.7 Complete backfill works at and around the scale foundations up to the required elevation. Cure the foundations.

.8 Supply and install conduits for the instrumentation works prior to backfill at and around the scale foundations.

.9 Supply and install the new scale on the concrete foundations. Complete all the anchoring of the scale supports stand and base plates including grouting.

.10 Complete all the earthworks and up to the required elevation for the new access truck laneway. Supply and install concrete approach slab at both ends of the in-bound and out-bound scales.

.11 Supply and install CCTV camera including the construction of support foundations, support stands, and required connections for instrumentation and cabling, wiring, etc.

.12 Supply and install new traffic control arms including construction of support foundations and required connection for instrumentation and cabling, wiring, etc.

.13 Supply and install sodding on the slope.

.14 Supply and install GEOWARE or Equal Approved software system. Supply and install all the required conduits, cable, and wiring to provide make connection and complete instrumentation between the scale house workstation, new 80-feet scales, CCTV camera, new traffic control, and other peripherals.

.15 Test the system and commission the new weigh scales.

.16 Install bollards and signs.

.17 Repair and restore the site damaged by construction activities and clean the area.

END OF SECTION

SECTION 01060
REGULATORY REQUIREMENTS

SECTION 01060
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines the regulations, standards and considerations governing this Contract.

1.2 CODES AND STANDARDS

.1 Comply with all provisions of the rules, regulations, and orders of Federal, Provincial and local Municipal government agencies applicable to the work under the Contract.

1.3 LABOUR

.1 Ensure all monies due the Workplace Safety and Insurance Board have been paid in full on the Contractor's behalf and that of his subcontractor.

.2 Furnish a certificate to this effect issued by the Board before the final release of monies owing the Contractor by the Owner and provide regular updates of the WSIB certificate with payment certificate submissions.

.3 Pay fair wages to employees and have hours of work conforming to the local municipal fair wage by-law, if any, and in conformity with laws and regulations of the Province of Ontario.

.4 Conform to the current *Occupational Health and Safety Act* and Regulations, Owner's Health and Safety Policies, and any or all other Acts and By-laws in force to ensure the safety of all workers and others engaged on the Site at all times

.5 For the purpose of the current *Occupational Health and Safety Act* and Regulations, the Contractor will be designated the Constructor.

.6 The Contractor will be held in strict conformance with all regulations enacted by the Federal and Provincial Governments in conjunction with the Workplace Hazardous Materials Information System.

1.4 PERMITS

.1 The Owner/Township of Minden Hills shall be responsible, at its cost, for obtaining the Building Permit, Site Plan Approval, and Environmental Compliance Approvals (Waste, Air and Sewage).

.2 Apply for, obtain, and pay for all other permits that are required for the project from the applicable authorities. The Owner/ Township of Minden Hills will provide a clean set of Contract Drawings and Specifications for the application.

.3 Adhere to and comply with all restrictions, inspections, construction requirements, etc. required by the permit issuing authorities.

1.5 HOURS OF WORK

.1 Normal working hours are considered to be between 7:00 a.m. and 7:00 p.m. Monday to Friday. The Contractor shall obtain written approval from the Township of Minden Hills and the Engineer if hours other than normal working hours are required or desired at least four days in advance of the contemplated change.

.2 Whenever, in the judgement of the Township of Minden Hills and the Engineer, it may be necessary or expedient to conduct work at night or on weekends, normal or statutory holidays, or after or before normal working hours, the Contractor without any additional or extra cost to the Contract, shall perform the work.

.3 The Contractor shall comply at all times with the Local Noise By-law and applicable by-laws for disposals and dust control. The Contractor shall be responsible for obtaining any noise-by-law exemption that may be required for equipment that must be kept in continuous operation.

1.6 RESPONSIBILITY OF THE CONTRACTOR

.1 The Contractor is to keep itself informed of governmental rules, regulations, and orders. The Contractor shall be fully versed in the Health and Safety Codes of the Township of Minden Hills and all utility companies.

.2 The Contractor is responsible for the implementation of regulatory requirements of any sub-contract he/she may enter. Ensure that the requirements of this article are a part of any subcontract he/she may enter into.

1.7 SUBMITTALS

.1 Submit to the Engineer before starting the work where it pertains, copies of all permits and approvals required by any government agency, road authority, authority, or utility company.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01300
SUBMITTALS

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines the submittals of shop drawings, samples and the associated supporting certificates, documents etc. required to support the submittals.

1.2 ADMINISTRATIVE

.1 Submit all listed submittals to the Engineer for review. Submit with reasonable promptness and in an orderly sequence so as to not cause a delay in the Works. 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 submittals shall not proceed until the review and approval process is complete.

.3 Review submittals prior to submission to the Engineer. This review confirms that each submittal has been checked and coordinated with the requirements of the Works and Contract Documents. Submittals not stamped, signed, dated and specifications certified as reviewed and identified as to specific project and specification section will be returned without being examined and shall be considered rejected.

.4 Notify the Engineer in writing, at the time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.5 Verify that field measurements and affected adjacent work have been coordinated.

.6 The Contractor’s responsibility for errors and omissions in submittals is not relieved by the Engineer's review of submittals. Review by the Engineer is for conformance with the design concept and compliance with the Contract Drawings and Documents.

.7 The Contractor’s responsibility for deviations in submittals from requirements of Contract Documents is not relieved by the Engineer's review.

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

1.3 SUBMITTALS

.1 Make all submittals generally described below to the Engineers adequately identified by including a reference to the specification item number or drawing number to which it is made.

1.4 SHOP DRAWINGS

.1 Submit the shop drawings to the Engineer for review.

.2 When submitting shop drawings, notify the Engineer in writing of all respects in which the shop drawings differ from the requirements of the Contract.

.3 Submit the shop drawing submissions with a transmittal letter containing the following:

.1 Date.

.2 Project tile, project number, and contract number.

.3 Contractor's name, address, and telephone number.

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

.5 All other pertinent data.

.4 Include in submission:

.1 Date, revision, and revision numbers.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by a contractor-authorized representative certifies approval of submissions, verification of field measurement, 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 of erection details

.4 Capacities

.5 Performance Characteristics

.6 Standards

.7 Operating weight

.8 Wiring diagrams

.9 Single line and schematic diagram

.10 Relationship to adjacent work

.5 It is the responsibility of the Contractor or his sub-contractor to review and sign all shop drawings before submission to intercept any errors or omissions.

.6 Provide only shop drawings, product data, and relevant information specific to the project.

.7 Include in every shop drawing submission, a copy of the relevant specification section, with addendum updates included, and all referenced and applicable sections. Check-mark each paragraph to indicate compliance with the specification or mark otherwise to indicate requested deviations from specified requirements. Check marks (√) denote full compliance with a paragraph in its entirety. If deviations from the specifications are indicated, underline each point of deviation and denote by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance with the specified requirements. Provide in the submittal a detailed, written justification for each deviation.

.8 Cross out, delete, or mark omitted on the information that does not pertaining to the supplied equipment.

.9 Do not start work until the Engineer has reviewed all shop drawings related to the said work.

.10 All drawings used on the job site must bear the completed Engineer reviewed stamp.

.11 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 MODIFIED”, all copies for use shall be modified and distributed, same as specified for “REVIEWED”.

.3 When Stamped “REVISE AND RESUBMIT, the necessary revisions shall be made and be re-submitted again for review.

.4 When stamped “NOT REVIEWED”, submit other drawings, data sheets, etc. for review that are consistent with the Contract Drawings and Specifications.

.12 Review of the Contractor's drawings by the Engineer will not relieve the Contractor of the correctness thereof, or from the results arising from any error or omission of details of design. Acceptance of drawings and specifications will be subjected to final approval of the equipment and materials after they have been put in commission, all guarantees have been fulfilled and the general operation of the equipment and materials have been found satisfactory to the Engineer.

.13 The Contractor shall allow three (3) weeks for the Township of Minden Hills and the Engineer to review the Contractor’s drawings and other submittals.

.14 Contractor shall carry costs of Engineer’s and the Township of Minden Hills review if shop drawing submissions are required in excess of two (2) times.

1.5 WORKING DRAWINGS

.1 Make no change to drawings and specifications after they have been accepted by the Engineer.

.2 In the event of alterations or changes authorized by the Engineer, submit each of the revised drawings and specifications indicating the changes to the Engineer for review.

.3 Dimension all drawings in metric units

1.6 SAMPLES

.1 Provide samples of materials and workmanship as required by the Engineer. Label the samples clearly as to the origin and intended use in the works. The Contractor will bear the expense of providing samples and proper storage as required.

.2 No material used in the work is to be inferior in any way to the material approved.

.3 Any material that is delivered to the site and is found to be unsuitable or unsound will be rejected by the Engineer.

1.7 OPERATING AND MAINTENANCE MANUALS

.1 Provide copies of all operation and maintenance instruction manuals to the Township of Minden Hills and the Engineer for review.

.2 All operation and maintenance instruction manual data for each system with the respective equipment in a separate indexed section of the manual, and the data are to be arranged in a logical, indexed manner outlining a systematic procedure for operations personnel to start up, shutdown, or manually override and operate all related equipment.

.3 Manuals should include, for all equipment provided under this contract, trouble-shooting procedures, preventative maintenance requirements, parts lists, lubricant tables, performance and materials specifications, and supplier contact names and telephone numbers.

1.8 CONSTRUCTION SAFETY MEASURES

.1 Submit a site-specific health and safety plan within five (5) working days after the date of Notice to Proceed or before mobilization on-site, whichever occurs first. The site-specific Health and Safety Plan must address the requirements of the Safety Acts.

.2 The Health and Safety Plan must meet the requirements of the following:

.1 Occupational Health and Safety Act, Regulations for Construction Projects, O. Reg 213/91, latest edition.

.2 Occupational Health and Safety Act, Regulations for Industrial Establishments Regulations, O. Reg 851, latest edition.

.3 Occupational Health and Safety Act, Regulation for Confined Spaces, O. Reg 632/05, latest edition.

.4 Occupational Health and Safety Act, Regulations for Designated Substances, O. Reg 278/05, latest edition.

.5 Revised Statutes of Ontario 1980, Chapter 321, Revised Regulation of Ontario 1980, Regulation 691 as amended by O. Reg. 156/84 and O. Reg. 645/86, and Ontario Regulation 714/82.

.3 Workers Safety & Insurance Board (WSIB) and municipal statutes and authorities:

.1 Comply with the requirements of the Workplaces Hazardous Materials Information System (WHMIS) regarding the use handling, storage, and disposal of hazardous materials and regarding labeling and the provision of material safety data sheets (MSDS) acceptable to Labour Canada.

.2 In the event of a conflict between provisions of the above authorities, the most stringent provision governs.

.3 Where applicable, the Contractor shall be designated “Constructor” as defined by Ontario Act.

1.9 CONSTRUCTION SCHEDULE

.1 The Contractor shall submit a construction schedule within 5 working days after the date of Notice to Proceed.

.2 The construction schedule will be reviewed by the Township of Minden Hills to ensure that the work by the contractor will not interfere with Landfill Site operations or work by other parties.

.3 The contractor shall modify the construction schedule upon agreement of all parties.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01351
HEALTH AND SAFETY

SECTION 01351
HEALTH AND SAFETY

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines the health and safety requirements and obligatory codes and standards to be followed pertinent to this Contract.

1.2 SUMMARY

.1 The Contractor, for purposes of the *Ontario Occupational Health and Safety Act*, shall be designated as the Constructor for this project and shall assume all of the responsibilities of the Constructor as set out in that Act and its regulations. The foregoing shall apply notwithstanding that the successful bidder has been referred to as the 'Contractor' in this and any other related document. The Contractor shall comply with the following:

.1 The Contractor acknowledges that the Contractor has read and understood the *Occupational Health and Safety Act (R.S.O. 1990*, C-0.1, as amended).

.2 The Contractor covenants and agrees to observe strictly and faithfully the provisions of the said *Occupational Health and Safety Act* and all regulations and rules promulgated thereunder.

.3 The Contractor agrees to indemnify and save the Owner harmless for damages or fines arising from any breach or breaches of the said *Occupational Health and Safety Act.*

.4 The Contractor agrees to assume full responsibility for the enforcement of the said *Occupational Health and Safety Act* to ensure compliance therewith.

.5 The Contractor further acknowledges and agrees that any breach or breaches of the *Occupational Health and Safety Act* whether by the Contractor or any of the Contractor's sub-contractors may result in the immediate termination of this contract.

.6 The Contractor shall allow access to the Work site on demand to representatives of the Owner to inspect Work sites to ensure compliance with the *Occupational Health and Safety Act.*

.7 The Contractor agrees that any damages or fines that may be assessed against the Owner by reason of a breach or breaches of the *Occupational Health and Safety Act* by the Contractor or any of the Contractor's sub-contractors will entitle the Owner to set-off the damages so assessed

against any monies that the Owner may from time to time owe the Contractor under this contract or under any other contract whatsoever.

.2 The Contractor shall provide a list of all controlled hazardous materials or products containing hazardous materials, all physical agents or devices or equipment producing or omitting physical agents and any substance, compound, product or physical agent that is deemed to be or contains a designated substance in accordance with the Workplace Hazardous Materials Information System (WHMIS) as defined under the Ontario *Occupational Health and Safety Act* and shall provide appropriate Material Health and Safety Data Sheets for these substances used for the performance of the required Work, all before the performance of the Work.

.3 Where hazardous materials, physical agents and/or designated substances are used in the performance of the required Work, the successful Contractor shall ensure that the requirements of the Ontario *Occupational Health and Safety Act* and associated regulations are complied with.

.4 The Owner reserves the right to cancel any contract for non-compliance with the terms set out herein, health and safety regulations, the *Environmental Protection Act*, associated regulations, and other applicable legislation.

.5 The Contractor shall perform the Work so as to cause the public the least inconvenience possible. In particular, the Contractor shall not obstruct any street, thoroughfare, or footwalk longer or to a greater extent than necessary.

1.3 CONSTRUCTION SAFETY MEASURES

.1 Contractor shall submit a site-specific Health and Safety Plan within five working days after the date of 'Notice to Proceed' or before mobilization on-site, whichever occurs first. The site-specific Health and Safety Plan must address the requirements of all applicable Acts.

.2 Meet the requirements of the most recent editions of:

.1 *Occupational Health and Safety Act*, Regulations for construction projects, O. Reg. 213 (as am. By O. Reg. 631), Part II General Construction.

.2 *Occupational Health & Safety Act*, Health Care and Residential Facilities Regulation, O. Reg. 67, Confined Spaces.

.3 *Occupational Health and Safety Act*, Industrial Establishments Regulation, R.R.O. 1990, Reg. 851 (as amended by O. Reg. 516; 630; 230; and 450), Part I Safety Regulations.

.4 Revised *Statutes of Ontario 1980*, Chapter 321, Revised Regulation of Ontario 1980, Regulation 691 as amended by O. Reg. 156 and O. Reg. 645, and Ontario Regulation 714.

.5 *Canada Labour Code, Canada Occupational Safety and Health Regulations*, SOR/86-304 (as amended by SOR/87-623; 88-44; 88-68; 88-632; 89-479; 89-515; 90-180; 91-448; 92-544; 94-33; 94-263; 95-286; 95-533; 96-294; 96-400; and 96-525), Part XI – Confined Spaces.

.6 Workers Safety & Insurance Board (WSIB) and municipal statutes and authorities.

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

.4 Where applicable, the Contractor shall be designated "Constructor" as defined by the *Ontario Occupational Health and Safety Act.*

1.4 OVERLOADING

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.5 SPECIAL PROTECTION AND PRECAUTIONS

.1 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.

.2 Comply with the requirements of CAN/CGA B-105-M-93 when working in and around hazardous locations/confined spaces.

.3 Conform to the requirements of working at and near the Hydro lines and strictly adhere to the Hydro One Codes and Policies.

.4 Conform to Ministry of Labour requirements for work in hazardous locations. Establish and implement written procedures to assure compliance.

.5 Provide documentation of tests for gas and oxygen deficiency prior to starting work in hazardous locations.

.6 Comply with the Township of Minden Hills/Owner's Health and Safety Procedures. An Owner staff member will provide one hour of training to a specified representative of the Contractor. The Contractor is responsible for providing the same training to all of his staff on-site. Maintain a record of training.

.7 Smoking is not permitted anywhere inside waste footprint, nor in hazardous areas or other areas as designated by the Owner. Post "No Smoking" signs as required.

PART 2 PRODUCT (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01450
QUALITY CONTROL

SECTION 01450
QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines the inspection and testing, administrative and enforcement requirements, and tests pertinent to this Contract.

1.2 INSPECTION

.1 Allow the Township of Minden Hills and the Engineer access to the Works at all times.

.2 Give a minimum of 72 hours advance notice requesting inspection if work is designated for special tests, inspections, or approvals by the Engineer's instructions.

.3 The Engineer may order any part of the Works to be examined if work is suspected to be not in accordance with Contract Documents. If, upon examination, such work is found not in accordance with Contract Documents, correct such work and pay the cost of examination and correction. If such work is found in accordance with Contract Documents, the Contractor will pay the cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 An Independent Inspection/Testing Agency will be engaged by the Township of Minden Hills for the purpose of inspecting and/or testing portions of Work. The cost of such services will be borne by the Township of Minden Hills.

.2 Employment of inspection/testing agencies does not relieve the Contractor from responsibility to perform work in accordance with the Contract Documents

.3 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain the full degree of defect. Correct defects and irregularities as advised by the Engineer at no cost to the Township of Minden Hills. The Contractor is to pay costs for retesting and re-inspection.

1.4 PRE-CONSTRUCTION AND POST-CONSTRUCTION SURVEY

.1 Undertake a pre-construction condition and crack survey of the existing buildings, structures, roads, gates, signs, gardens, trees, shrubs, grasses, ground cover, benches, sidewalks, pathways, equipment, fixtures, luminaires and fences in the vicinity of the proposed construction, that are not scheduled to be demolished.

.2 Undertake a pre-construction and post-construction topographic survey of the work areas. The pre-construction survey shall be submitted prior to the commencement of construction works.

.3 Undertake a survey of existing surface finish conditions.

.4 Document findings with photographs and in writing. Video may also be acceptable.

.5 Submit one copy, with original photographic prints, to the Engineer at the commencement of construction.

.6 Survey existing buildings and structures within 15 meters of the new works that are not scheduled to be demolished.

.7 Before the substantial performance, conduct a post-construction comparison survey of all of the above-listed items in Item 1.4.1.

.8 Repair damage due to construction and restore to the original condition without any additional cost to the Township of Minden Hills.

1.5 PROCEDURES

.1 Notify the appropriate agency and the Engineer in advance of the requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in the specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delays in work.

.3 Provide labor and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REJECTED WORKS

.1 Remove defective work, whether a result of poor workmanship, use of defective products or damage, and whether incorporated in work or not, which has been rejected by the Engineer as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 If, in the opinion of the Engineer, it is not expedient to correct defective work or work not performed by the Contract Documents, the Township of Minden Hills may deduct from the Contract Price the difference in value between work performed and that called for by Contract Documents, which amount shall be determined by the Engineer

1.7 TESTS AND MIX DESIGN

.1 Furnish test results and mix designs for:

.1 Concrete test and mix-design.

1.8 MILL TEST

.1 Submit mill test certificates as required of Specifications Sections.

1.9 MINIMUM STANDARD

.1 The Specifications and the Contract Drawings define a minimum standard of Workmanship. The Contractor shall include in the Tender, the cost of any additional work or improvements in the quality of the Works that the Contractor considers necessary to unconditionally guarantee the performance of the completed work in conformity with the Contract for the Guaranteed Maintenance Period.

1.10 WORKMANSHIP

.1 The quality of the workmanship and materials shall be of first-class quality and the Works shall present a neat and attractive appearance when finished.

.2 Should the Engineer find the work and/or materials are faulty in any respect, the Contractor shall remove and make good all defective work and/or materials and shall bear the expense of all such materials, items, inspection, and making good of the works and items.

.3 Should the Engineer/Owner(Township of Minden Hills) find the installation of scale house doors, windows, plumbing items, electrical fixtures, and equipment such as scales, CCTV cameras, traffic control arms, ticket printers, intercom, works stations and other peripherals faulty in any respect, the Contractor shall remove and make good all defective work and/or materials and shall bear the expense of all installations, inspections and making good and /or replacement of items.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01505
MOBILIZATION AND DEMOBILIZATION

SECTION 01505
MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines requirements of mobilizing and demobilizing at the Site.

1.2 MOBILIZATION

.1 Mobilization includes activities that must be performed to enable construction to commence on site. This includes but is not limited to:

.1 Obtaining certificates from all Utility Companies or Departments having facilities in the area of proposed work, confirming that a stake out of existing utilities has been done or indicating that there are no such services in the area of proposed work.

.2 Locating and confirming all survey control points.

.3 Clearly marking trees to be preserved and erecting tree protection hoarding.

.4 Erecting all signs, barricades, flashers, delineators, flagging, and such other protection as may be required to protect the public during construction.

.5 Providing all necessary access to the project including haul roads as required.

.6 Providing site safety and security fence defining the Contractor's working area. The exact locations of fences will be subject to the approval of the Township of Minden Hills.

.7 Erecting project signboards.

.8 Moving onto site and setting up offices, storage facilities, sanitary facilities, hydro, telephone, and other utilities as specified or required.

.9 Bringing on site the workers, equipment, and machinery necessary to undertake the performance of the Work.

.10 Delivering, accepting, and storing the materials necessary for initiating the performance of the Work.

1.3 DEMOBILIZATION

.1 Generally, demobilization covers the activities required to be performed at or after completion of construction. This includes but is not limited to:

.1 Disconnection of all temporary utilities and removal of offices and temporary facilities for the Site.

.2 Removal of project signs and supporting framework.

.3 Reinstatement of all areas disturbed during construction to original, better or specified condition.

1.4 BASIS OF PAYMENT

.1 Indicate the cost for mobilization and demobilization in the Detailed Contract Price Breakdown under this Specification Section. The payment for mobilization shall not exceed 60 percent of the mobilization/demobilization amount.

.2 The payment for mobilization can be included in the first application for payment. The Engineer may allow only a partial payment to reflect the degree to which mobilization has been carried out.

.3 The payment for demobilization can be included in the application for payment following Substantial Performance and/or Completion of the Work. The Engineer may allow only a partial payment to reflect the degree to which demobilization has been carried out.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01510
TEMPORARY UTILITIES

SECTION 01510
TEMPORARY UTILITIES

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines temporary utilities for the work including power, water, heating, ventilation, and communication facilities to be used during construction.

1.2 RELATED SECTIONS

.1 Division 1: Section 01535: Temporary Facilities.

1.3 INSTALLATION AND REMOVALS

.1 Provide temporary utilities and controls in order to execute work properly, safely, and expeditiously.

.2 Remove all temporary utilities from the site after use, unless otherwise directed by the Owner (Township of Minden Hills) / Engineer or specified in this specification.

.3 Make all necessary applications, obtain permits, and pay for all hook-ups, fees, and charges for service and use.

1.4 WATER SUPPLY

.1 The Contractor shall provide a continuous supply of potable water for construction use.

.2 The Contractor shall obtain all necessary approvals for water supply. The Contractor shall be responsible for the cost of consumption.

1.5 TEMPORARY HEATING AND VENTILATION

.1 Any construction heaters used inside a temporary facility must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.

.2 Provide temporary heat and ventilation in enclosed areas as required to

.1 Facilitate progress of the Work.

.2 Protect the Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide appropriate ambient temperatures and humidity levels for storage, installation, and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.3 Maintain inside temperatures above a minimum of 10 degrees C in, and adjacent to, areas where construction is in progress or ongoing.

.4 Ventilating:

.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in a 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 a period of time after cessation of work process to assure removal of harmful contaminants.

1.6 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction and temporary lighting and operating of power tools.

.2 Whenever power or lighting in operating areas of the West Carleton Landfill Site are interrupted by construction activity, provide temporary facilities.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for telephone hook-up and equipment necessary for the Contractor's own uses.

.2 Refer to Section 01535 Temporary Facilities for other temporary communication facility requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01520
CONSTRUCTION FACILITIES

SECTION 01520
CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines site access, security, fire protection, signage, fencing, and construction facilities including storage and required equipment for construction.

1.2 INSTALLATION AND REMOVALS

.1 Provide construction facilities to execute work safely and expeditiously.

.2 Remove all such work from the site after use.

.3 Make all necessary applications, obtain permits and all fees are paid by the Contractor.

1.3 SCAFFOLDING AND SUPPORTS

.1 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary steps, and stairs as required to complete the work.

1.4 HOISTING

.1 Provide, operate, and maintain hoists and cranes required for moving of materials and equipment.

.2 All hoist cranes shall be operated by qualified operators.

1.5 SITE STORAGE AND LOADING AREA

.1 Confine the working area and operations of employees as required by Contract Documents.

.2 Do not unreasonably encumber premises with products. Store materials and equipment in the Contractor’s storage area only.

.3 Do not place materials or equipment in a manner that will interfere with the Township of Minden Hills operations.

.4 Do not load or permit the loading of any part of the Work with a weight or force that will endanger the Work.

.5 If stored equipment, tools or materials interfere with plant operations, remove promptly when directed by the Township of Minden Hills/Engineer.

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during the performance of the Work required by governing codes, regulations, and By-laws.

.2 Burning rubbish and construction waste materials is not permitted on site.

1.7 VEHICULAR ACCESS AND PARKING

.1 Parking and Traffic Control:

.1 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 completion of the Work and if required to temporarily block traffic then provide flag person(s) to direct traffic acceptable to local municipal authorities. Remove accumulations of ice and snow from areas providing access to the Site. Ensure that access is available for emergency vehicles. Comply with the fire plan for vehicular traffic.

.3 Provide roads, walks, ramps, stairs, and other such means of access as necessary. Maintain access to service entrances of existing buildings at all times, including access for delivery vehicles.

.4 Do not create a nuisance to public traffic at any time. Manage construction traffic by using designated roads and by providing trained flag persons to direct public traffic as appropriate.

.2 Construction Parking:

.1 Designated parking will be permitted on site provided that it does not disrupt the performance of Work, site safety or the movement of vehicular or pedestrian traffic and is acceptable to the Township of Minden Hills.

.2 Parking shall be limited to the area designated, within the Contract limit of Work. The Township of Minden Hills will not be responsible for parking fines incurred by contractors, Sub-Contractors or their employees.

1.8 EQUIPMENT, TOOLS AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment, and materials.

.2 Locate materials not required to be stored in weatherproof sheds on-site in a manner to causes the least interference with work activities and normal operation of the existing landfill site facility.

1.9 SECURITY AND CONSTRUCTION FENCING

.1 Provide construction fencing around the perimeter of the contract and working limits as shown on the drawings.

.2 The Contractor shall be responsible for maintenance of the fences and surveillance of the work to provide security at all times against vandalism of the work and injury to persons not involved with construction.

.3 Security deemed necessary for protection against loss of or damage to any equipment, temporary materials, tools, or permanent materials on site in relation to the project shall be the sole responsibility of the Contractor. Provide and maintain a security gate at the entrance to the site as agreed with the Township of Minden Hills.

1.10 CONSTRUCTION TRAILERS AND PORTABLE TOILET

.1 The Contractor will be permitted to locate trailers only within the limits of the Contract.

.2 Contractor shall provide portable toilets as per Health and Safety by-laws and applicable standards. The contractor is responsible for the regular maintenance of cleanliness, water supply, hand washing, sanitary rolls, heating, and ventilation for the well-being and hygiene of the users of portable toilets.

.3 The Contractor shall be responsible for providing water, wastewater, power, telephone, and internet connection to his trailer, as specified.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01535
TEMPORARY FACILITIES

SECTION 01535
TEMPORARY FACILITIES

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines requirements for temporary facilities not incorporated into the final or permanent work.

1.2 RELATED SECTIONS

.1 Division 1: Section 01510: Temporary Utilities.

.2 Division 1: Section 01520: Construction Facilities.

.3 Division 1: Section 01560: Environmental Protection.

1.3 GENERAL

.1 Furnish, install and maintain temporary facilities required for performance of the Work.

.2 Remove temporary facilities upon completion of the Contract or when directed by the Township of Minden Hills and the Engineer.

1.4 SITE / FIELD OFFICE AND WORKERS LUNCH ROOM FACILITY

.1 Provide temporary site and/or field office, and worker's lunch room area and facilities for construction purposes at location approved by the Township of Minden Hills before work commences.

1.5 TEMPORARY UTILITIES

.1 Provide all temporary water, power, ventilation, heat and air-conditioning and light required during construction.

.2 Make all necessary applications, obtain permits and pay for all fees and charges for service and use.

.3 Install and maintain the temporary power and light system subject to the inspection and approval of the local authority. Post / affix the inspection certificate on the wall of the site office.

.4 Provide all necessary cables, panel boards, outlets and enclosures.

.5 Pay for all temporary services required during construction.

1.6 FIRST AID FACILITIES

.1 Provide and maintain on-site completely equipped first-aid facilities in a clean and orderly condition, and readily accessible to all staff at all times.

.2 Designate certain employees who are properly instructed to be in charge of first-aid. At least one such employee shall always be available on the site while work is being carried on.

.3 Conspicuously post telephone call list for summoning aid, such as doctors, ambulances, rescue squads, nearby Hospital address and emergency numbers etc.

.4 Furnish facilities as required by the Workplace Safety and Insurance Act and the Ministry of Labour (MOL).

1.7 SANITARY FACILITIES

.1 Provide sufficient sanitary facilities in accordance with the MOL requirements for all persons employed on Contract subject to approval of type, size and location by the local health authorities, the Ontario Ministry of the Environment, and the Engineer.

.2 Maintain facilities with all required toilet room supplies in a clean and sanitary condition and disinfect frequently.

.3 Prohibit the committing of sanitary nuisance on the site.

.4 Remove any contaminated soil and replace with fresh clean material. Leave the facility in a clean sanitary condition on a daily basis.

1.8 SIGNS

.1 Erect project signboards at the site at locations agreed by the Township of Minden Hills.

.2 Supply and install suitable wooden posts, backing and bracing to support the signboards and signs. Install the signboards on the support structures.

.3 On attainment of “Substantial Performance”, or at such earlier time as may be approved by the Engineer, remove the construction and project signboards and support structures, and make good the areas.

.4 Throughout the construction period maintain the project signs in good condition.

.5 No other signs, other than warning signs and notices required by law, may be erected on site without the approval of the Township of Minden Hills.

1.9 SECURITY AND CONSTRUCTION FENCING

.1 Provide construction safety barriers and fencing around the perimeter of the construction work area.

1.10 CONSTRUCTION TRAILERS

.1 The Contractor will be permitted to locate trailers only within the limits of the Contract.

.2 The Contractor shall be responsible for providing water, wastewater, power, telephone, internet connection to his trailer, as specified.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01561
ENVIRONMENTAL PROTECTION

SECTION 01561
ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines requirements for environmental controls including control of noise, dust, surface water and erosion, various pollution control methods and handling of Designated Substances as well as compliance with the *Occupational Health and Safety Act* and Site Safety requirements for temporary facilities not incorporated into the final or permanent work.

1.2 GENERAL

.1 Establish and maintain site procedures such that noise levels, dust from construction areas are minimized.

.2 Control noise level in accordance with local by-laws and Ministry of the Environment Conservation and Parks (MECP) Standards.

.3 Prevent dust nuisance resulting from construction operations at all locations on the site.

.4 Protect existing services, land, water courses.

.5 No extra compensation will be paid for any dust or other control equipment and water supplied and applied on Saturdays, Sundays or holidays.

1.3 MEASURES

.1 Noise Controls:

.1 Do not use faulty vehicles, machineries, tools and equipment which are unsafe.

.2 Provide and use devices that will minimize noise levels in construction areas.

.2 Dust Control:

.1 Dust shall be controlled through wetting down with water and power sweeping the access routes and all the traffic areas.

.2 Transport dusty materials in covered haulage vehicles.

.3 Use of calcium chloride shall not be allowed for the control of dust.

.3 Mud Control:

.1 Keep the site access road and public roadways clean and free from mud.

.2 Provide mud mats and/or wash stations to prevent tracking of mud from any portion of the contract limits onto any paved roadway.

1.4 REFUELLING AREAS

.1 Review all proposed construction areas to plan access routes and fuelling areas, brows of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.2 Do not refuel or maintain equipment adjacent to or in watercourse or over water supply aquifers unless non-spill facilities are used.

.3 Do not fuel equipment within 30 metres of any watercourse unless otherwise non-spill facilities are used.

1.5 SPILLS

.1 Be prepared at all times to intercept, clean-up and dispose of any spillage that may occur whether on land or water.

.2 Keep all materials required for clean-up of spillages readily accessible on site.

.3 Report immediately any spills causing damage to the environment to:

.1 The MECP Spills Centre: 1-800-268-6060,

.2 Engineer, and

.3 Township of Minden Hills.

1.6 MANAGEMENT AND DISPOSAL OF EXCESS MATERIALS

.1 The requirements of OPSS 180 shall apply except for the following revision/ amendments:

.1 Subsection 180.07.02, Conditions on Management by Reuse, shall be amended by the addition of the following:

.1 "Recycled hot mix asphalt or excess bituminous pavement shall not be used as trench backfill or bedding".

.2 Subsection 180.07.04, Conditions on Management by Open Burning, shall be deleted. No open burning will be permitted.

.3 The Township of Minden Hills must be given first right of refusal of any excess materials.

1.7 FIRES

.1 Fires and burning of rubbish on the site are not permitted.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01640
MANUFACTURERS SERVICES

SECTION 01640
MANUFACTURERS SERVICES

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This Section defines the requirements to have the equipment manufacturer inspect, check, adjust and commission their equipment at the jobsite and train City's personnel. Certification that their equipment is installed to their satisfaction and performing in accordance with specification is also required.

1.2 DEFINITIONS

.1 Person-Day: One person for 8 hours within regular Contractor working hours.

1.3 SUBMITTALS

.1 Training Schedule: Submit not less than three (3) weeks prior to start of equipment installation and revise as necessary for acceptance.

.2 Lesson Plan: Submit proposed lesson plan not less than three (3) weeks prior to scheduled training and revise as necessary for acceptance.

1.4 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

.1 Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system. Additional qualifications may be specified elsewhere.

.2 Representative subject to acceptance by City and Engineer. No substitute representatives will be allowed unless prior written approval has been given by Engineer.

PART 2 PRODUCTS

2.1 GENERAL

.1 At a minimum, the following products require Manufacturer's Services:

.1 Supply / Exhaust Fans

.2 Unit Heaters

.3 AC Unit

.4 Gas Detection Equipment

.5 Variable Frequency Drives

.6 Automatic Transfer Switch

.7 OIT (Operator Interface Terminal)

PART 3 EXECUTION

3.1 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

.1 Furnish manufacturers' services when required by an individual specification section, to meet the requirements of that Section.

.2 Schedule manufacturer's services to avoid conflict with other onsite testing or other manufacturers' onsite services.

.3 Determine, before scheduling services, that all conditions necessary to allow successful testing have been met.

.4 Only those days of service approved by Engineer will be credited to fulfill the specified minimum services.

.5 Allow for two (2) full day review meetings with supplier, following submittal of first shop drawing, for the following: Bypass Pump Systems, Process Pumps, Grinders, MCC's, and RPU Panels. Meetings shall be scheduled 2 weeks following first shop drawing submittal.

.6 System Integrator to attend a one (1) day Software Standard workshop with the City PCS group.

.7 When specified in individual specification sections, manufacturer's onsite services shall include:

.1 Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction for Contractor's assembly, erection, installation or application procedures.

.2 Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.

.3 Revisiting the site as required to correct problems and until installation and operation are acceptable to Engineer.

.4 Resolution of assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.

.5 Assistance during functional and performance testing and facility startup and evaluation in accordance with Section 01800 – Equipment Testing and Starting of Systems.

.6 Training of City's personnel in the operation and maintenance of respective product in accordance with Section 01830 - Training.

3.2 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

.1 When specified in individual Specification section, submit manufacturer's certificate of compliance prior to shipment of product or material.

.2 Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by acceptable certification of compliance.

.3 Certificates of compliance shall be signed by product manufacturer certifying that product or material specified conforms to or exceeds specified performance. Attach supporting reference data, affidavits and certifications, as appropriate.

.4 Certificates of compliance may reflect recent or previous test results on material or product, if acceptable to Engineer.

3.3 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

.1 When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by the equipment manufacturer's representative.

.2 Such form shall certify that the signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

3.4 SUPPLEMENTS

.1 Refer to forms listed in Part 4.

PART 4 FORMS

4.1 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

CITY _____ EQPT SERIAL NO:_____

EQPT TAG NO:_____ EQPT/SYSTEM:_____

PROJECT NO:_____ SPEC. SECTION:_____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Comments:_____

_____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date:_____, 20

Manufacturer:_____

By Manufacturer's Authorized Representative: _____

END OF SECTION

SECTION 01740
CLEANING

SECTION 01740
CLEANING

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines requirements for cleanliness and final cleaning pertaining to this project.

1.2 PROJECT CLEANLINESS (PROGRESSIVE CLEANING)

.1 Maintain the site in tidy condition, free from accumulation of waste products and debris.

.2 Dispose of waste materials and debris off the site. Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site.

.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide on-site containers for collection of waste materials and debris. Collect waste material and debris from site and deposit in waste containers at end of each working day.

.5 Provide and use clearly marked separate bins for recycling.

1.3 FINAL CLEANING

.1 Prior to Substantial Completion, remove surplus products, tools, construction machinery and equipment not required for performance of remaining work.

.2 Remove waste products and debris and leave the site clean and suitable for occupancy and use.

.3 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures.

.4 Clean lighting reflectors, lenses, and other lighting surfaces.

.5 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.6 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.7 Remove dirt and other disfiguration from exterior surfaces.

.8 Sweep and wash clean paved areas.

.9 Clean the drainage systems.

.10 Remove debris and surplus materials from the site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01760
WARRANTY OF WORK

SECTION 01760
WARRANTY OF WORK

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines the warranties and their submissions pertaining to this project.

1.2 SUMMARY

.1 Provide all warranties outlined in the Contract Documents from the time of Substantial Completion of the Work or components of the Work.

.2 Perform warranty work required during the progress of the Work and the Warranty Period.

1.3 SUBMITTALS

.1 Inform the Township of Minden Hills in writing of the arrangements made for carrying out warranty work during the Warranty Period.

.2 Provide a valid telephone number and official address for receipt of notices relating to matters requiring action by the Contractor during the Warranty Period.

1.4 INSPECTION AND DECLARATION OF TOTAL PERFORMANCE

.1 Request inspection for Total Performance no later than 20 working days before the expiry of the Warranty Period.

.2 Participate in a joint inspection of the Work for the purpose of establishing Total Performance.

.3 Review with the Township of Minden Hills the status of all Warranty items carried out during the Warranty Period.

.4 Complete all outstanding deficiencies, repair noted defects, complete all outstanding warranty items and obtain the Engineer's written agreement that all Work is complete in accordance with the Contract Documents.

1.5 WORK DURING WARRANTY PERIOD

.1 Perform all warranty work required upon receipt of written notices from the Township of Minden Hills.

.2 Repair or make good to defects identified for scale house, deck, handrailing, disability ramp, and steps.

.3 Repair or make good settlements and defects on surfaces of backfilled trenches or excavations.

.4 Repair all damages to structures caused by settlement of ground adjacent to or over-excavation.

1.6 REPAIR BY THE TOWNSHIP OF MINDEN HILLS

.1 Upon receipt of verbal or written notice from the Township of Minden Hills, the Contractor must take immediate action for the repair of defects that are dangerous in nature, that constitute an extreme emergency or that affect the operation of the Work.

.2 In the case where Township of Minden Hills will carry out emergency repair of such defects, the cost of labor, equipment and material to perform emergency work will be charged to the Contractor and will be deducted from the retention money.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01770
CLOSEOUT PROCEDURE

SECTION 01770
CLOSEOUT PROCEDURE

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section outlines the administrative procedures preceding preliminary and final inspections of the Work for the purpose of issuance of the Certificate of Substantial Performance.

1.2 INSPECTION AND DECLARATION OF SUBSTANTIAL PERFORMANCE

.1 Contractor’s Inspection: The Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects, and repair as required to conform to the Contract Documents.

.2 Notify the Township of Minden Hills and the Engineer in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made and request the Engineer's Inspection.

.3 The Township of Minden Hills and Engineer's Inspection: The Engineer, the Township of Minden Hills and the Contractor will perform the inspection of the Work to identify obvious defects or deficiencies and the Contractor will correct the Work accordingly.

.4 Completion: Submit a written certificate that the following has been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been fixed and deficiencies have been rectified and/or corrected.

.3 All the equipment, devices and systems have been tested, adjusted, Calibrated, and balanced and are fully operational.

.4 Electrical, HVAC, and instrumentation inspections and approvals are complete and submitted.

.5 Traffic management and weigh scale software application system has been tested and is fully functional.

.6 Redline Markups completed and submitted. All required documentation has been submitted.

.7 Operation of systems has been demonstrated to the Township of Minden Hills's personnel.

.8 All required training has been delivered.

.5 Final Inspection: When items noted above are completed, request for the final inspection of the Work to be conducted by the Engineer and the Township of Minden Hills .

.6 Complete the outstanding work or deficiencies arising out of the final inspection that are deemed to affect issuance of Substantial Performance.

.7 Agree to a list of outstanding work and deficiencies that do not affect Substantial Performance with the Engineer.

.8 Apply for Substantial Performance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01780
CLOSEOUT SUBMITTALS

SECTION 01780
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section specifies requirements for keeping and submission of as-constructed/as-recorded drawing and specifications, operation and maintenance manuals, warranties and bonds during and at completion of contract work.

1.2 RELATED SECTIONS

.1 Division 1: Section 01820: Demonstration and Training

1.3 SECTION INCLUDES

.1 Record drawings, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.4 SUBMISSION

.1 Prepare instructions and data by personnel experienced in the maintenance and operation of described products and submit two copies for the Engineer's review.

.2 One copy will be returned with comments and one copy will be retained to assist the Engineer and will be returned after delivery of the final copies.

.3 Revise the content of documents as required prior to final submittal.

.4 Ensure spare parts, maintenance materials and special tools provided are new, undamaged and not defective, and of the same quality and manufacture as products provided in the Work.

.5 If requested, furnish evidence as to type, source and quality of products provided.

.6 Defective products will be rejected, regardless of any previous inspections by the Engineer or other agents of the Township of Minden Hills. Defective products to be replaced at the Contractor's expense.

.7 Pay the costs of transportation related to replacement of defective products.

1.5 OPERATION AND MAINTENANCE DATA

.1 The Contractor shall prepare and submit an organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified herein and in individual sections of Divisions 2 to 16 of these specifications.

.2 General

.1 Assemble, coordinate, bind and index required data into an Operation and Maintenance Manual.

.2 Submit two preliminary manuals to the Engineer for review at least 15 working days prior to the start of training in accordance with Section 01820. One set will be returned with comments and the other will be returned after receipt of the three completed sets.

.3 Submit complete Manuals to Engineer prior to Application for Substantial Performance of the Work. Submission of the Operating and Maintenance Manual will be one of the conditions precedents to the certifying of Substantial Performance.

.4 Organize the data into the same numerical order as the Contract Specifications, i.e. by Division and Section number.

.5 Label each section with tabs, protected with celluloid covers, fastened to hard paper dividing sheets.

.6 All contents must be typewritten and printed with clearly readable.

.7 The Contract Drawings, diagrams and manufacturers' literature must be legible and reflect the actual products installed.

.8 Ensure the information depicts "as constructed" conditions.

.9 The O & M manuals must contain all start-up reports in conformance with the Township of Minden Hills Project Implementation Procedures (PIP) Design Manual. Provide all information requested in the PIP Manual.

.3 Binders

.1 Submit four sets bound in vinyl coated, hard-covered post type binders. Ensure these sets are fully organized and indexed.

.2 Identify the contents of each binder on the cover and spine.

.3 Binders shall be “hot stamped” with white lettering on both the cover and spine.

.4 Contents

.1 Binder No. 1

.1 Cover sheet containing:

.1 Date submitted.

.2 Project title, location and Project Number.

.2 Names and addresses of the Contractor and all sub-contractors.

.3 Table of contents of all binders.

.4 List of Maintenance Materials.

.5 List of Special Tools.

.6 List of Spare Parts.

.7 Warranties, guarantees certification.

.8 Copies of approvals and certificates.

.9 Equipment alignment certificates.

.2 Remaining Binders

.1 Cover sheet containing:

.1 Date Submitted.

.2 Project title, location and Project Number.

.2 Provide data as specified below in individual sections of Divisions 2-16 of the specifications. Where manufacturers' literature covers several models or options, the applicable information shall be highlighted and inapplicable information crossed out.

.1 List of equipment including service depot, service representatives, name, address and telephone number.

.2 Name plate information including equipment number, make, size, capacity, model number and serial number.

.3 Parts list.

.4 Installation details.

.5 Operating Instructions.

.6 Maintenance Instructions for equipment.

.7 Maintenance Instructions for finishes.

.8 Description of system, components and technical data. Include interfaces, sequences, operational characteristic and changes for seasonal operation.

.9 Lubrication charts.

.10 Schematics, single line, and wiring diagrams.

.11 Suppliers for replacement parts - name, address and telephone number.

.12 Test results; witnessed testing and commissioning.

.13 Troubleshooting data.

.14 Preventive maintenance program complete with suggested check list sheets.

.15 Test data of degreasing and flushing of piping.

.16 Hydrostatic or air tests performance.

.3 Submit one electronic version of the complete operation and maintenance manual on CD.

1.6 RECORD DRAWINGS AND SPECIFICATIONS

.1 The Township of Minden Hills will provide two sets of whiteprints for Record Drawing purposes.

.2 Maintain project Record Drawings and accurately record in red on one set of whiteprints the following:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimensions and details.

.5 Changes made by Change Orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Specifications: legibly mark each item to record actual construction, including:

.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.

.5 Store record documents in field office apart from documents used for construction.

.6 Other Documents: maintain manufacturers' certifications, inspection certifications, field test records, as required by individual specification sections.

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

.8 Make available for reference purposes and inspection at all times.

.9 Prior to applying for Substantial Performance, neatly transfer record documentation to the second set of whiteprints using fine, red marker. Neatly print lettering in size to match original. Draw lines with a straight-edge, neatly and accurately. Add at each drawing title block the words "Record Drawing". Also, circle on the List of Drawings the title and number of each Drawing marked with record information.

.10 Submit this second set of Record Drawings to the Engineer.

1.7 EQUIPMENT AND SYSTEMS

.1 Each item of equipment and each system: include description of unit or system, and component parts. Give 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 Panel board circuit directories: provide electrical service characteristics, controls and communications, final as-constructed diagram.

.3 Include as-constructed installed colour coded wiring diagrams in the manual and also provide an electronic copy in Township of Minden Hills' approved format in MicroStation or AutoCAD.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer where appropriate.

.9 Provide original manufacturers' parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer where appropriate. Include copies in the manuals and provide an electronic version in Township of Minden Hills's approved format in MicroStation or AutoCAD.

.11 Provide coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturers' spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports.

.15 Additional requirements: As specified in individual specification sections.

1.8 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site location and place in storage as directed by the Township of Minden Hills.

.4 Obtain receipt for all delivered products from the Township of Minden Hills and submit these receipts prior to Substantial Performance.

1.9 MAINTENANCE MATERIALS

.1 Provide 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 location and place in storage as directed by the Township of Minden Hills.

.4 Obtain receipt for all delivered products from the Township of Minden Hills and submit these receipts prior to Substantial Performance.

1.10 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site location and place in storage as directed by the Township of Minden Hills.

.4 Obtain receipt for all delivered products from the Township of Minden Hills and submit these receipts prior to Substantial Performance.

1.11 STORAGE, 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 manufacturers' 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 the Contractor's own expense and to the satisfaction of the Engineer.

.6 Exercise all equipment in strict conformance with the equipment manufacturers' written instructions during storage and following installation. Provide all equipment exercise logs to the Engineer for review.

1.12 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.

.4 No warranty will commence until issuance of Substantial Performance on respective work components. The warranty on items used during construction, with the Township of Minden Hills's permission, for the safe and orderly completion of the Work will not commence until Substantial Performance.

.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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01800
STARTING SYSTEMS

SECTION 01800
STARTING SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section outlines the general requirements for start-up of the entire works, including all checks and tests necessary to verify all of the systems are installed as specified.

.2 Initial operation will not commence until all systems have been demonstrated to the Engineer as being ready for operation in both manual and auto operating modes.

1.2 GENERAL

.1 All test equipment gauges, thermometers, meters, analysis instruments, and other equipment used for calibrating or verifying the performance of equipment installed under this contract shall be provided by the Contractor.

.2 All water, chemicals, fuel oil, lubricants and other materials required to start-up equipment shall be provided by the Contractor.

.3 Contractor's Inspection: The Contractor and all Subcontractors and Suppliers will conduct an inspection of the work, identify deficiencies and defects; repair as required. Notify the Engineer in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made. Request an Engineer's Inspection.

.4 Engineer's Inspection: Engineer and the Contractor will perform an inspection of the Work to identify defects or deficiencies.

.5 The Contractor will correct all critical deficiencies identified through Engineer's inspection prior to start of initial operation.

.6 Final Inspection: When the items noted above are complete, request a final inspection of the work by the City, the Engineer and the Contractor. If work is deemed incomplete, complete the outstanding items and request a re-inspection.

1.3 PRE-INITIAL OPERATION CHECKS AND TESTS

.1 Pre-initial operation checks and tests are predominantly a construction phase activity completed by Contractor, subs and suppliers and do not involve City staff or operations. It will confirm that equipment and devices are installed and connected correctly and are ready to be placed on line for initial operation.

.2 Obtain all approvals and clearances from authorities prior to energizing any components.

.3 Perform all necessary pre-initial operation checks and tests as per the following:

.1 Check installations are in accordance with manufacturer instructions.

.2 Check all electrical, and related power and control panels are complete and tested.

.3 Check and calibrate all related protective devices.

.4 Check all pre-run maintenance and installation conditions have been completed such as oil and grease addition.

.5 Obtain clearance from manufacturers to place equipment or systems in operation and obtain certificates of installation from manufacturers.

.4 The Contractor shall notify the Engineer in writing at least 48 hours in advance that all systems are ready for the Engineer's Inspection. A period of five (5) working days shall be allowed in the schedule for this inspection.

.5 The Contractor shall be entirely responsible for the equipment and its operation during this period. Should any equipment be damaged during this period, the Contractor shall repair or replace such equipment to the satisfaction of the Engineer, at no extra cost to the City.

.6 During the pre-initial operation, the Contractor shall make all changes and adjustments to the equipment at his own expense, and shall demonstrate to the Engineer that the equipment is capable of proper operation, and is ready for initial operation and subsequent performance testing as specified in the respective sections.

1.4 SUBMITTALS

.1 Submittal material, shall consist of the following:

.1 Copies of all factory test reports for components where factory testing was carried out.

.2 Copies of all signed certificates of installation.

.3 Copies of all calibration reports, I/O check sheets, electrical supply and distribution integrity test reports, piping and tank test reports, etc.

.4 ESA Reports

.5 Contractor's major deficiencies and corrective action report.

1.5 PERIOD OF OPERATION

.1 Provide assistance during the initial period of operation prior to date of Substantial Performance of the Project.

.2 When installation work has been completed and before any equipment is operated, commission the equipment. Provide the manufacturers' services of a skilled technical

representative for each major piece of equipment for a minimum period of two days (16 hours) at each of the eight (8) facilities to carry out the following work as a minimum requirement.

.1 Check the installation as to its workmanship.

.2 Check the operation.

.3 Check the interconnecting wiring of the safety devices.

.4 Perform further tests as directed by the Engineer.

.3 When installation work has been completed and the equipment has been commissioned, the Contractor will operate the equipment for a period of not less than fourteen (14) days uninterrupted service per Section 01825.

.4 The Contractor will provide all necessary fuels required during the initial period of operation.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 01825
PERFORMANCE TESTING

SECTION 01825
PERFORMANCE TESTING

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 The Contractor recognizes and agrees that the Performance and Reliability Run is for the purpose of establishing that the works can be operated as intended and that it shall be successfully completed prior to Substantial Performance.

1.2 RELATED SECTIONS

.1 Division 10

.2 Division 13

.3 Division 15

.4 Division 16

.5 Process Control Narratives

1.3 QUALITY ASSURANCE

.1 Provide a calibration program for all instruments used for determining the performance of equipment and systems installed under this Contract.

.2 Provide a testing plan detailing how all testing work required under this Contract will be implemented. The test plan shall be divided into process systems or areas for ease of preparation and implementation.

.3 Provide a testing schedule detailing sequence, time and duration of performance and operational testing. The schedule shall follow a bar chart form and shall be updated as required to reflect changes.

.4 The testing program shall include all tests necessary to demonstrate the specified performance for all process, mechanical, electrical, instrumentation, and HVAC equipment and systems installed under this Contract.

.5 Provide all documentation necessary to record the results of all equipment and system tests.

.6 For the purposes of this section, a system shall include all items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The Contractor's Testing Manager shall co-ordinate the activities of all sub-contractors and suppliers to implement the requirements of this section.

.7 All test equipment and other equipment used for calibrating or verifying the performance of equipment installed under this Contract shall be calibrated to within plus or minus 2 percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale.

.8 The Contractor shall assemble a team under the direction of the Contractor's Start-up Manager, an individual capable of operating the facility, organizing the required testing program, and duly authorized to commit the Contractor's personnel and resources to respond to requests for assistance on the part of the Engineer or, through the Engineer, the Township of Minden Hills. The team shall consist of representatives of the Contractor's mechanical, electrical, and instrumentation sub-contractors, and others as appropriate. The team shall be available at the site of the work during normal working hours (8 hours a day, 5 days a week (Saturdays, Sundays, and legal holidays excepted)) and shall be available within 2 hours' notice at all other times upon notice by telephone. The team shall at all times be equipped and ready to provide for emergency repairs, adjustments, and corrections to the equipment and systems installed and modified as a part of this Contract.

1.4 PERFORMANCE TESTING – GENERAL

.1 The roles and responsibilities during the performance and reliability run are defined as follows:

.1 The Contractor: The Contractor will place all systems on-line ready for continuous operation and complete all cleaning, disinfection and preparatory works to permit the works to be operated and tested as intended.

.2 The Engineer: The Engineer will monitor the performance and reliability run on behalf of the Township of Minden Hills. The Engineer will assess whether any abnormalities affect the integrity of the test during this period.

.3 The Township of Minden Hills: The Township of Minden Hills will assist the Contractor for reading instruments, recording notes and making measurements and observations during the tests. The Township of Minden Hills will report any abnormalities to the Engineer promptly throughout the test period.

.4 System Programmer: The programmer of the control system will ensure that the control programs are placed on-line ready for continuous operation and will provide support to operations staff throughout the test as required to maintain the control systems in full time operation.

.2 The sequence of procedure to undertake this portion of the work will be:

.1 Calibration of testing instruments

.2 Instrument loop checks

.3 Equipment and system performance test

.4 Operational testing of equipment and system

.5 System commissioning

.3 The works will not be turned over to the Owner for operation until the operational testing and reliability run period has been completed to the satisfaction of the Consultant and Owner.

.4 Abnormalities and/or component failures during the performance and reliability run may result in the entire test being repeated or extended or components being repeated or extended at the discretion of the Engineer.

.5 The Scope of Work of this Contract includes the performance and reliability run and Substantial Performance is conditional on completion of this test period to the satisfaction of the Engineer.

1.5 PERIOD OF PERFORMANCE TESTING

.1 Upon satisfactory completion of the initial operating period, and when the equipment has been adjusted to the satisfaction of the Engineer, and all critical deficiencies corrected, the Contractor shall operate the equipment continuously for a two (2) week period.

.2 The Contractor shall notify the Engineer in writing at least 72 hours in advance of starting the “performance tests” period. Operation shall not be initiated until written approval from the Engineer is received.

.3 If the performance tests demonstrate, in the opinion of the Engineer, that the equipment or any part of it or any of the appurtenances, fails to meet any of the specified guarantees and other performance requirements of the Specifications of this Contract, the Contractor shall at his own expense, if directed by the Engineer, modify, replace or reconstruct any and all defective parts of said equipment and appurtenances to fulfill all of said contract requirements including retesting.

.4 After the performance tests have been completed, and after all required adjustments, repairs changes, replacements and reconstruction have been made to

the satisfaction of the Engineer and the Township of Minden Hills, the Contractor shall place all parts of the equipment and all appurtenances in smooth running order, and thereupon the Contractor shall apply for Substantial Performance.

.5 Without limiting the scope of the above, the Contractor is referred to other sections of these Specifications for specific requirements for performances testing of equipment supplied under this Contract.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 01830
TRAINING

SECTION 01830
TRAINING

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section contains requirements for training the Township of Minden Hills's personnel, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this contract.

1.2 RELATED SECTIONS SPECIFIED ELSEWHERE

.1 Manufacturers Services – Section 01640

.2 Closeout Submittals – Section 01780

1.3 DESCRIPTION

.1 The Township of Minden Hills will provide a list of personnel to receive instructions.

.2 The Township of Minden Hills will pay the Township of Minden Hills's staff for all costs associated with demonstrations and training, including time, travel lodgings, etc. The Township of Minden Hills reserves the right to deduct the cost of any cancellations or repeat sessions necessary as a result of the Contractor's actions from any monies due to the Contractor under this Contract.

1.4 QUALITY ASSURANCE

.1 The Contractor shall provide on-the-job training of the Township of Minden Hills's personnel as specified in Clause 2.6. The training sessions shall be conducted by qualified, experienced (2 years minimum), factory-trained representatives of the various equipment manufacturers. Training shall include instruction of operating personnel in equipment operation and preventive maintenance and instruct facility mechanics, electricians, and electronics technicians in normal maintenance up to major repair.

1.5 SUBMITTALS AND SCHEDULE

.1 The following information shall be submitted to the Engineer. Due to phased testing and start-up activities, separate submittals can be prepared for equipment items or systems. The material shall be reviewed and accepted by the Engineer no later than 10 working days prior to initial operation.

.1 All factory training programs, if required, shall be completed prior to starting of systems and use equipment similar to that being supplied.

.2 Where the same personnel are used for starting of system and for training, ensure that the starting of system work is completed to the satisfaction of the Engineer and the Township of Minden Hills before the training commences and that sufficient time is set aside to complete the training.

.3 Lesson plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.

.4 Allow sufficient time in the construction schedule and test plan for completion of training.

.5 Co-ordinate attendance of training specialists with availability of the Township of Minden Hills's personnel.

.6 Date, time, and subject of each training session and identity and qualifications of individuals to be conducting the training.

.7 All training shall be completed prior to performance testing. Feedback training sessions may be required at a later date.

.8 All field training programs shall be fully co-ordinated with construction and initial operation.

.9 Training schedule

.1 Concurrent classes will not be allowed.

.2 All training sessions will be conducted Monday to Friday 0800 hrs to 1500 hrs.

.10 Maintain a record of all attendees for demonstration and training sessions and submit to the Engineer, along with a report on all sessions prior to Substantial Performance.

PART 2 PRODUCTS

2.1 GENREAL

.1 The Contractor shall conduct training sessions for the Township of Minden Hills's operation and maintenance personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work. Vendor operation and maintenance manuals shall be available to the Township of Minden Hills personnel at least 30 working days prior to the date scheduled for initial operation.

2.2 LOCATION

.1 Field training sessions shall take place at the site of the equipment. The Contractor shall provide a training facility with a capacity for at least 12 persons for classroom training.

2.3 LESSON PLANS

.1 Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject. The Contractor shall furnish as required hardcopies of all necessary training manuals, handouts, visual aids and reference materials.

2.4 MATERIALS FOR TRAINING

.1 Electronic copies of all training material (presentations, supporting material, manuals, etc.) to be provided for the Township of Minden Hills's review three (3) weeks prior to the scheduled training session.

.2 All training materials to be approved by the Township of Minden Hills and Engineer prior to commencement of training session.

.3 Course Materials: Provide sufficient written materials to support all training sessions.

.4 All materials provided for training shall conform to the following:

.1 Paper: 8.5 x 11 inch 20-lb minimum, white, for typed pages.

.2 Text: Manufacturer's printed data, or neatly word processed, designed specifically for learning. Ample space to be provided for note taking.

.3 Double-sided.

.4 Drawings and Sketches:

.1 Provide reinforced punched binder tab, bind in with text.

.2 Reduce larger drawings to a size not larger than 11 x 17 inches and fold to size of next pages.

.3 Use colour prints to highlight key elements.

.5 Cover to include:

.1 Contract number.

.2 Title of project.

.3 Identify separate structures or systems as applicable.

.4 Identify of general subject matter covered in the manual.

.5 Locations or facility names.

.6 Publication date.

.7 Revision number.

.6 Binder shall be:

.1 Commercial quality (D-ring) binders with durable and cleanable plastic covers.

.2 Maximum post width: 2 inches.

.3 When multiple binders are used, the Contractor shall correlate the information into related consistent groupings and clearly number all volumes.

.7 Recorded Training Material:

.1 The use of standard recorded materials will be considered provided it is professionally produced, and reviewed and approved by the Township of Minden Hills prior to its use. Recordings shall be in DVD format and shall become the property of the Township of Minden Hills.

.2 The use of this material shall be viewed as an enhancement to the required face-to-face training and not a substitute.

.3 The Township of Minden Hills reserves the right to videotape all training sessions.

2.5 FORMAT AND CONTENT

.1 Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, a training session shall cover the following topics for each item of equipment or system:

.1 Purpose and function of equipment

.2 Safety items and procedures

.3 Operation

.4 Troubleshooting

.5 Preventive maintenance, including special details on lubrication, maintenance and corrosion protection of the equipment and ancillary components.

.6 Corrective maintenance

.7 Equipment Components and Spare Parts

.8 Maintenance Tools and Kits

.9 Local representatives

.10 Operation and maintenance manuals

2.6 TRAINING SESSIONS

.1 Provide sufficient demonstration to cover start up, operation, control adjustment, calibration, trouble-shooting, servicing, maintenance and shut down of all components of the works. Contractor to provide all tools and equipment required to provide a complete and thorough demonstration.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

.1 Training shall be conducted in conjunction with initial operation. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. The Contractor shall arrange to have the training conducted on consecutive days, with no more than 4 hours of classes scheduled for any one day.

3.2 OPERATOR CLASSROOM TRAINING

.1 As a minimum, classroom equipment training for operations personnel will include:

.1 Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.

.2 Purpose and facility function of the equipment.

.3 A working knowledge of the operating theory of the equipment.

.4 Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.

.5 Identify and discuss safety items and procedures.

.6 Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.

.7 Operator detection, without test instruments, of specific equipment trouble symptoms.

.8 Required equipment exercise procedures and intervals.

.9 Routine disassembly and assembly of equipment if applicable (as judged by the Township of Minden Hills on a case-by-case basis) for purposes such as operator inspection of equipment.

3.3 OPERATOR HANDS-ON TRAINING

.1 At a minimum, hands-on equipment training for operation personnel will include:

.1 Identify location of equipment and review the purpose.

.2 Identifying instrumentation:

.1 Location of primary element.

.2 Location of instrument readout.

.3 Discuss purpose, basic operation, and information interpretation.

.3 Discuss, demonstrate, and perform standard operating procedures and round checks.

.4 Discuss and perform the preventative maintenance activities.

.5 Discuss and perform start-up and shutdown procedures.

.6 Perform the required equipment exercise procedures.

.7 Perform routine disassembly and assembly of equipment if applicable.

.8 Identify and review safety items and perform safety procedures, if feasible.

3.4 MAINTENANCE CLASSROOM TRAINING

.1 Classroom equipment training for the maintenance and personnel will include:

.1 Theory of operation.

.2 Description and function of equipment.

.3 Start-up and shutdown procedures.

.4 Normal and major repair procedures.

.5 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the “pass” and “no pass” test instrument readings.

.6 Routine and long-term calibration procedures.

.7 Safety procedures.

.8 Preventive maintenance such as lubrication; normal maintenance such as belt, seal, and bearing re-placement; and up to major repairs such as re-placement of major equipment part(s) with the use of special tools, welding jigs, etc.

3.5 MAINTENANCE HANDS-ON TRAINING

.1 Hands-on equipment training for maintenance and repair personnel shall include:

.1 Locate and identify equipment components.

.2 Review the equipment function and theory of operation.

.3 Review normal repair procedures.

.4 Perform start-up and shutdown procedures.

.5 Review and perform the safety procedures.

.6 Perform Township of Minden Hills-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

.7 Review and use equipment manufacturer’s manuals ‘in the hands-on training.

END OF SECTION

DIVISION 2

SITE WORK

SECTION 02100
SITE PREPARATION

SECTION 02100
SITE PREPARATION

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section specifies requirements for clearing and grubbing, stripping and storing topsoil, vegetation removal on the site in preparation for construction of scale house, deck, weigh scale foundations, ramp, curbs and associated services including plumbing, sanitary, electrical and instrumentation.

1.2 RELATED WORKS SPECIFIED ELSEWHERE

.1 Division 1: Section 01561: Environmental Protection.

1.3 DEFINITIONS

.1 Clearing:

.1 Excavation and removal of topsoil, unwanted materials, Cutting off to not more than 0.30 meter above ground of tree trunks and branches and disposing of all materials including fallen timber and surface debris.

.2 Grubbing:

.1 Excavating and disposing of stumps and roots below original ground surface.

1.4 PROTECTION

.1 Protect trees and shrubs as required.

.2 Identify and protect existing features which are to remain.

.3 Field check the location and size of existing trees and other features of the work site. Clearly mark trees and other special sites to be preserved to avoid inadvertent damage.

.4 Determine the location of all existing utilities, and any other services, at the site before initiating any site works. Maintain and preserve these facilities at no risk to the City.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

.1 Areas to be cleared and grubbed as per the Contract Drawings, and as necessary.

.2 Identify and protect significant environmental features and wildlife habitats before clearing and grubbing.

.3 Clear trees, shrubs, brush, vegetation, fences, abandoned surface utilities and other debris where necessary.

.4 Grub-embedded boulders, stumps, and logs where necessary.

.5 Break up and remove existing abandoned foundations, buried pipes and utilities within the site as necessary.

3.2 STRIPPING TOPSOIL

.1 Strip and remove from the site all topsoil from areas to be excavated, and from working areas. Stripped topsoil shall be stockpiled on site at a location approved by the Engineer.

.2 Remove all topsoil, organic or deleterious materials from beneath the proposed foundations and pavement areas.

.3 Clear and grub and remove surface vegetation from all areas prior to stripping topsoil.

.4 Remove topsoil carefully to not mix topsoil with subsoil or other materials.

.5 Prevent ponding of water at locations where topsoil is stripped.

3.3 DISPOSAL OF MATERIALS

.1 Dispose of trees, branches, bushes, stumps of trees, vegetation, fences, excess and unsuitable topsoil and excavated materials off-site to designated and approved locations/dumpsite.

.2 Do not burn any debris at any time.

END OF SECTION

SECTION 02220
EXCAVATION, TRENCHING AND BACKFILLING

SECTION 02220
EXCAVATION, TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section specifies the requirements and guidelines for excavation, trenching and backfilling works to be carried out pertinent to this project.

1.2 RELATED ONTARIO PROVINCIAL STANDARDS SPECIFICATIONS (OPSS)

.1 OPSS 180 - Management and Disposal of Excess Material

.2 OPSS 401 - Construction Specification for Trenching, Backfilling and Compacting

.3 OPSS 418 - Construction Specification for the Control of Water from Dewatering Operations.

.4 OPSS 577 - Temporary Erosion and Sediment Control Measures

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C117-95, Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C 13 95a, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D 422 -63(1990), Test Method for Particle Size Analysis of Soils.

.4 ASTM D 698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN m/m^3).

.5 ASTM D 1557-91, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN m/m^3).

.6 ASTM D 4318 -95, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 8.1 88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB 8.2 M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA):

.1 CAN/CSA A23.1 94, Concrete Materials and Methods of Concrete Construction.

1.4 DEFINITIONS

.1 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Waste material: excavated material unsuitable for use in the work or surplus to requirements.

.3 Borrow material: material obtained from locations outside the area to be graded, and required for construction of fill areas or for other portions of the work. The source is to be approved by the Engineer.

.4 Common Excavation: material, of whatsoever nature, excavated to complete works as specified and indicated and includes but not necessarily limited to: earth, trees, tree stumps, deadheads, pipes, tanks, masonry, asphalt pavement, concrete sidewalks, concrete pavements, concrete curbs and gutters, timber, hard pan, shale fractured shale, logs, quicksand, fill, cinders, snow, ice, frost, any combination of these with normal or abnormal earth conditions, or any other obstacles encountered in the excavation, all of which must be removed.

.5 Selected Excavated Material: material that is free from cinders, ashes, refuse, vegetable or organic matter, boulders, rocks, or stones with nominal dimensions greater than 100mm, paving material, timbers, unbroken or frozen masses of earth, and other material which in the opinion of the Consultant is unsuitable. Selected excavated material to have properties to meet specified compaction requirements.

.6 Unsuitable materials: the following may be classified as unsuitable:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than ten when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB 8.1.

.7 Unshrinkable fill: very weak (0.4 to 0.7 MPa) mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 SAMPLES

.1 Inform the Engineer at least ten working Days prior to commencing work, of proposed source of fill materials and provide access for sampling.

1.6 PROTECTION OF EXISTING FEATURES

.1 Existing buried utilities and structures:

.1 The indicated size, depth and location of existing utilities and structures shown on the drawings are for guidance only. Completeness and accuracy are not guaranteed.

.2 Contractor shall confirm locations of buried utilities by careful test excavations utilizing hydro-vac excavation or by hand.

.3 Maintain and protect from damage all water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated on the Contract Drawings.

.4 Record location of maintained, re-routed and abandoned underground lines.

.2 Existing buildings and surface features:

.1 Conduct with the Consultant, a condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by the work.

.2 Protect existing buildings and surface features from damage while the work is in progress. In event of damage, immediately make repair to approval of the Consultant.

.3 Where required for excavation, cut roots or branches as approved by the Consultant.

.3 Monuments:

.1 Adequately protect benchmarks, layout markers, survey markers and geodetic monuments. Contractor shall replace damaged or destroyed monuments and markers at their sole cost.

1.7 SITE CONDITIONS

.1 Subgrade Conditions: Refer to geotechnical report.

.2 Existing Grades:

.1 Elevations indicated on the Drawings give approximate site grades. Contractor to verify prior to commence any construction works.

.2 Actual grades may vary slightly.

.3 Notify the Engineer of any significant discrepancy in the existing grades before disturbing the site conditions.

1.8 EXCAVATED MATERIAL

.1 Contractor shall make all arrangements for the disposal of surplus excavated materials including deleterious materials in accordance with all authorities having jurisdiction.

1.9 COLD WEATHER WORK

.1 Obtain written permission from the Consultant before starting excavation in frozen ground. Written authorization from the Consultant must be obtained for methods to be used to carry out such work.

.2 All excavations shall be protected to prevent frost from penetrating the ground below the foundations. Any structure laid on frost which, in the opinion of the Consultant, has been injured through neglect of this clause of the Specifications shall be removed and made good by the Contractor at the Contractor's expense.

.3 Backfilling shall not be done with frozen material and no fill shall be placed over material which is already frozen.

.4 Replace any excavated frozen material with suitable backfill material at no additional cost to the City. Frozen material may be stockpiled on site at a designated area agreed with the City for use after thawing.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Granular:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB 8.1.

.3 Granular A to OPSS 1010.

.4 Granular B to OPSS 1010.

.5 HL-8 stone to OPSS 1003.

.6 19 mm stone per OPSS 1001.

.2 Unshrinkable fill:

.1 Proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m^3.

.3 Minimum strength of 0.7MPa at 24h.

.4 Concrete aggregates: to CAN/CSA A23.1.

.5 Portland cement: Type 10.

.6 Slump: 160 to 200 mm.

PART 3 EXECUTION

3.1 SHORING, BRACING AND UNDERPINNING

.1 Contractor shall provide all temporary supports, shoring, bracings for excavations to depths as required to complete the work.

3.2 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while the work is in progress.

3.3 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated on the Contract Drawings.

.2 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.3 Where excavations cross existing asphalt or concrete, the asphalt or concrete shall be saw-cut neatly to the width required.

.4 For trench excavation, unless otherwise authorized by the Consultant in writing, do not excavate more than 30m of trench in advance of installation operations and do not leave open more than 15m at end of day's operation.

.5 All excavated materials shall be segregated by type. Separate stockpiles shall be maintained for shale, select native material, organic soils, and any hazardous or otherwise unsuitable soils.

.6 Soil and rock stockpile perimeters shall be surrounded by silt fences constructed per OPSD 219.110 to prevent sediment laden runoff from the stockpiles. Silt fences shall be inspected on a weekly basis at a minimum, and shall be repaired and extended as necessary or as directed by the City.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify the Engineer when the bottom of the excavation is reached.

.10 Obtain Engineer approval of completed excavation.

.11 Remove unsuitable material from trench bottom to extent and depth as directed by the Engineer.

.12 Correct unauthorized over excavation by filling with Granular B Type 2 fill compacted to not less than 100% of Standard Proctor Maximum Dry Density (SPMDD).

.13 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to the approval of the Consultant.

3.4 FILL TYPES AND COMPACTION

.1 Use Granular A and Granular B (as specified on drawing) for fill material with each lift not exceeding 200mm and compaction to be 100% SPMDD and in consultation with geotechnical engineering team. Refer to contract drawings for fill material thicknesses.

3.5 BEDDING AND SURROUNDING OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surrounding of underground services as indicated on the Contract Drawings.

.2 Place bedding and surround material in unfrozen condition.

3.6 BACKFILLING

.1 Do not proceed with backfilling operations until the Engineer has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material as indicated on the Contract Drawings in uniform layers not exceeding 200 mm compacted thickness up to grades indicated. Compact each layer to not less than 98% of SPMDD before placing succeeding layer.

3.7 RESTORATION

.1 Upon completion of the work, remove waste materials and debris, trim slopes, and correct defects as directed by the Engineer.

.2 Clean and reinstate areas affected by the work to the satisfaction of the Engineer.

END OF SECTION

SECTION 02250
COMPACTION CONTROL AND TESTING

SECTION 02250
COMPACTION CONTROL AND TESTING

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section specifies the requirements for compaction control and testing throughout progress of work.

1.2 RELATED SECTIONS

.1 Division 2: Section 02220: Excavating, Trenching and Backfilling

.2 Division 2: Section 02318: Excavation and Backfilling for Structure

.3 Division 2: Section 02500: Roadway Construction and Restoration

1.3 DEFINITIONS

.1 Standard Proctor Density: As defined in ASTM D698, modified Proctor Density.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 MATERIALS TESTING

.1 Testing of all materials is to be performed by the Engineer.

.2 The Contractor shall supply representative samples of granular materials for testing at the source before delivery, as specified or as directed by the Engineer.

.3 All material tests are to be paid for by the Township and coordinated by the Engineer.

.4 Provide labour to obtain and handle samples at worksite or at source of materials.

3.2 COMPACTION TESTING

.1 Where compaction of subgrade, bedding, backfill, fill, granular base or asphalt is specified, the Engineer may order a compaction test by an independent testing company.

.2 Testing will be performed throughout progress of work to determine adequacy of compaction.

.3 Contractor is to cooperate with inspection staff during testing.

.4 In-situ density tests will be performed at intervals to check that the fill materials, subgrade, pipe bedding, cover and backfill, sidewalk base, pavement materials, etc. are placed and compacted as specified.

.5 For fill or backfill compaction, tests will be completed for every 300 mm maximum depth of material placed.

.6 If the in-situ density tests do not meet the required specifications, additional compaction of the materials, or excavation, removal, and replacement of the unsuitable materials with the necessary compaction effort shall be required to rectify the problem at no additional cost to the Township.

.7 Should more than two compaction tests be required to confirm adequate compaction at any location, the cost of all additional compaction costs beyond the initial two tests shall be the carried out by of the Contractor.

END OF SECTION

SECTION 02318
EXCAVATION AND BACKFILLING FOR STRUCTURE

SECTION 02318
EXCAVATION AND BACKFILLING FOR STRUCTURE

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section refers to the excavation and backfilling for all structures.

1.2 SUMMARY

.1 Excavations and backfilling shall be carried out for areas as specified and shown on the drawing.

.2 The work includes:

.1 Excavation of all material including rock and removal of unsuitable materials; offsite disposal of unsuitable materials; and backfilling to lines and grades shown on the drawings.

.2 Supply of materials and construction of fills.

.3 Submit reports of soil classification in accordance with Ontario Ministry of Environment and Climate Change - Environmental Protection Act, Regulation 347, for excavated material and for imported fill material.

1.3 REFERENCE

.1 CSA A23.1 - Concrete Materials and Methods of Concrete Construction.

.2 ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

.3 ASTM D2922 -Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

.4 ASTM D3017 - Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

.5 OPSS 1010 - Material Specification for Aggregates - Granular A, B, M, and Select Subgrade Material.

.6 Regulations for Construction Projects, Ontario Regulation 213/91, made under the Occupational Health and Safety Act, Revised Statutes of Ontario, 1990, Chapter O.1.

1.4 PROTECTION OF EXISTING FEATURES

.1 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated on the drawings are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify the City and Engineer, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction from Engineer before moving or otherwise disturbing utilities or structures.

.5 Record location of maintained, re-routed and abandoned underground lines.

.2 Existing buildings and surface features:

.1 Conduct, with Engineer's presence, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, paving, wires and survey benchmarks and monuments which may be affected by work.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

.3 Record location of surface features.

1.5 REGULATIONS

.1 Observe all regulations of the current Occupational Health and Safety Act.

1.6 SITE CONDITIONS

.1 The contractor shall examine the site and geotechnical report to ascertain any special condition and become familiar with any object, which may affect the work of this section. No extra payment will be made for work resulting from a failure to know existing conditions. Examine all drawings for work that might affect excavation and backfill.

1.7 CONSTRUCTION METHODS

.1 Select methods of excavation, dewatering and construction suitable for actual conditions encountered in the work. The Contractor is solely responsible for the safety and adequacy of the method employed.

.2 Submit proposed construction methods for earthwork construction of all structures for a review two weeks prior to commencement of construction.

.3 Submit excavation plans showing subgrade elevations, side slopes of open cut excavations and extent of excavation shoring. Indicate new excavations and foundation system in relation to the existing utilities, structures, or surface features that may be affected by works of this contract.

.4 The submittals will be reviewed for general conformance with project requirements.

1.8 QUALITY ASSURANCE

.1 All material supplied by the Contractor is subject to inspection and testing at the discretion of the Engineer.

.2 At least four (4) weeks prior to commencing work furnish the Engineer with a list of sources of materials and provide without charge sufficient samples, tests and reports as may be required for the Engineer's review.

.3 Provide moisture density curves for each type of imported material if required to be compacted to a specified density.

.4 Moisture density curves shall be in accordance with ASTM D698.

.5 Preliminary approval of material on site, or supplied by the Contractor, does not constitute general acceptance. Acceptance depends upon satisfactory field test results and performance in place.

PART 2 PRODUCTS

2.1 GENERAL

.1 Obtain fill materials from approved material excavated under this contract, Material obtained from borrow pits or other sources have to be submitted and reviewed by the Engineer. Use borrowed material only if available suitable native material from the excavated material has been used up.

.2 Fill, backfill and bedding materials shall meet the gradation requirements specified. Frozen material shall not be used for backfilling.

.3 Excavation includes all material excavated to complete the works as specified and shown in the Drawings. No extra payment will be allowed on account of existing trees, tree roots, timber, boulders, quicksand, snow, ice, frost, any combination of these with normal or abnormal earth conditions, or any other obstacles encountered in the excavation, all of which must be removed.

2.2 FILL AND BACKFILL MATERIALS

.1 Native material: Excavated material as shown on the drawings or borrow material free from roots, boulders larger than 150 mm, organic matter and building debris.

.2 Granular Fill Materials: Non-frost susceptible composed of clear, hard, durable sand, gravel or crushed rock, free from shale, clay, friable or soluble materials, organic matter and other deleterious substances.

.3 Granular "A" material: OPSS 1010, Granular “B” material Type I and Type II): OPSS 1010, Type mix, as recommended by the geotechnical engineer.

.4 Clear Stone: 19 mm clear crushed stone to OPSS 1004, crushed rock composed of hard, angular fragments produced from rock formations. Granular Fill Materials with minimum 90% passing 22.4 mm sieve and maximum 10% passing 9.75 mm sieve.

.5 Unshrinkable fill to be provided as follows:

.1 Maximum compressive strength of 0.7MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m^3.

.3 Minimum strength of 0.4 MPa at 24h.

.4 Concrete aggregates: to CAN/CSA A23.1.

.5 Portland cement: Type 10.

.6 Slump: 160 to 200 mm.

PART 3 EXECUTION

3.1 EXCAVATION

.1 Excavate and remove all materials to depths and dimensions necessary to provide adequate space for foundations, bracing, supporting formwork, and all other new construction works.

.2 Have the Engineer inspect and approve the subgrade before proceeding with construction of engineered granular fill. Place granular fill to underside of foundations as specified on the Approved for Construction Drawing.

.3 Take all necessary preventive measures to protect the subgrade from disturbance or due to inclement weather or construction activities. Make excavation in the dry.

.4 Notify Engineer when soil at bottom of excavation appears unsuitable and proceed as directed by Engineer.

.5 Dispose of unsuitable excavated material off site.

.6 In addition to the requirements of the Occupational Health and Safety Act, protect excavation faces against erosion or sliding.

.7 Remove and dispose-off site all natural obstructions, like cobbles and boulders, encountered during excavation.

.8 Where required due to unauthorized over-excavation, correct at no additional cost to the City as follows: Fill material compacted to 98% SPMDD.

3.2 PREPARATION OF SUBGRADE

.1 Remove and replace soft spots with Granular 'A' fill as prescribed in Section 3.1.

.2 Immediately following excavation, proof-roll the subgrade with a minimum of two passes of a 2-tonne vibratory compactor.

.3 Obtain Engineer's approval prior to placing material.

3.3 FILL TYPES AND COMPACTION METHOD

.1 Use fill of types as indicated or specified below unless otherwise specified or mentioned on the Approved for Construction Drawing. Compaction densities are percentages of maximum densities obtained from ASTM D698 corrected maximum dry density.

.1 Engineered granular fill to underside of base slab: Granular "B" Type II placed in 300 mm thick layers and compact to 98% SPMDD as specified on the drawings.

.2 Backfill of structures: Granular "B" Type I placed in 200 mm thick layers and compact to 98% SPMDD as shown and specified on the drawings.

.3 Under concrete slabs: provide 150 mm compacted thickness base course of 19 mm clear stone compacted to 98% SPMDD as specified and shown on drawings.

.4 Cable trenches: provide trench bedding and fill materials as shown and specified on drawings.

.5 Sewer trenches: Provide trench bedding and fill materials as shown and specified on the drawings.

.2 Where possible, place layers simultaneously on all sides of installed work to equalize loading.

.3 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground. Do not use backfill material, which is frozen or contains ice, snow or debris. All filling material shall have moisture content in the range of ±3% from the optimum moisture content.

.4 Use mechanical, hand compaction or vibrating plate equipment to achieve the required SPMDD value of compaction.

.5 Contractor will rectify all settlement that occurs in the backfill during the maintenance period, at no extra cost to the City.

3.4 DEWATERING

.1 Keep excavation free of water while work is in progress.

.2 Protect open excavation against flooding and damage due to surface runoff.

.3 Dispose of water in a manner not detrimental to public and private property or any portion of the work completed or under construction.

.4 Submit for Engineer's review details of proposed dewatering methods.

3.5 DISPOSAL OF MATERIALS

.1 Dispose of unsuitable and surplus excavated materials on site at approved disposal locations. Transport materials in a manner approved by the City’s By-laws.

3.6 RESTORATION

.1 Upon completion of work, remove from site surplus materials and debris, trim slopes and correct defects noted by Engineer. Clean and reinstate areas affected by work as directed by Engineer.

3.7 INSPECTION AND TESTING

.1 Testing of materials and compaction will be carried out by an approved testing company, retained by the City.

.2 It is contractor’s responsibility to coordinate with the testing agency and obtain test results.

.3 If, during process of the work, tests indicate that specified requirements are not achieved, remove, replace, re-compact and retest at no additional cost to the City.

END OF SECTION

SECTION 02370
EROSION AND SEDIMENT CONTROL

SECTION 02370
EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section refers to the supply, installation, maintenance and removal of all required erosion and sediment control facilities including fencing, check dams, siltation ponds, discharge controls, erosion control blankets, etc. as required for the prevention of the erosion of on-site materials and the deposition of the eroded materials as sediment on and/or off-site.

1.2 RELATED SECTIONS

.1 Division 1: Section 01561: Environmental Protection

.2 Division 2: Section 02100: Site Preparation

.3 Division 2: Section 02220: Excavating, Trenching and Backfilling

.4 Division 2: Section 02318: Excavating and Backfilling of Structures and Trenches

1.3 SITE REQUIREMENTS

.1 The Contractor shall meet or exceed the requirements of all environmental legislation and regulations related to erosion and sediment control.

.2 All erosion and sediment control issues that occur on-site shall be urgently brought to the attention of the Engineer for resolution.

.3 Erosion and sediment controls shall comply with all the requirements shown in the Contract Drawings and as directed by the Engineer.

.4 Silt fence shall comply with OPSD 219.100, 219.180, 219.210 and 219.211 as directed by the Engineer.

.5 Geotextile used for sediment fence shall conform to OPSS 1860.

.6 All control measures necessary to meet the requirements of the project shall be in place prior to any land disturbance on site. These measures shall be maintained by the Contractor during the period of construction in a manner satisfactory to the Engineer to ensure adequate compliance with the requirements of the contract documents and to prevent damage occurring as a result of erosion, sedimentation and flooding. At a minimum, the controls shall include sediment fence installed around the perimeter of the work. In addition, sediment check dams shall be placed wherever concentrated surface runoff could possibly exit the site.

.7 The Engineer shall inspect the site prior to the initiation of land disturbance to ensure compliance with the approved requirements.

.8 Any water pumped from excavations or trenches on the site shall be treated with appropriate controls before discharge on or off-site to ensure compliance with applicable guidelines and regulations.

.9 The Contractor shall ensure compliance via frequent monitoring of operation.

.10 Existing storm drainage systems, or any other inlets and outlets, shall be protected with appropriate erosion control measures.

.11 Runoff from adjacent areas passing through the site shall be diverted around disturbed areas, if practicable, and as directed. Otherwise, the drainage course shall be protected with appropriate measures to reduce sediments being carried off-site.

.12 Any stockpile containing more than one hundred (100) cubic meters of material shall be protected with the appropriate sediment control facilities and shall not be located within a downslope drainage distance 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 subject to the Engineer's approval. Erosion from stockpiles that are intended to remain in place for less than thirty (30) days shall be controlled with appropriate measures as approved by the Engineer.

.13 Runoff from the entire disturbed site shall be controlled.

.14 A mud tracking prevention program and public access/road cleaning shall be required to be completed by the Contractor for the duration of the project to ensure materials are not carried off-site or deposited on adjacent public roads. Any mud tracked onto roadways, sidewalks, etc. shall be cleaned, scraped or otherwise removed daily and as directed by the Engineer. Failure to adequately control mud at the site as required may result in the Engineer arranging for the cleanup by others with all costs incurred by such cleanup shall be the responsibility of the Contractor.

.15 All trucks which are loaded with excavated material shall be covered with tarps to prevent the release of the excavated material enroute to the approved disposal site.

.16 The Contractor shall be prepared, if necessary, to moisten the excavated material in the trucks prior to leaving the site.

.17 The Contractor shall maintain all road drainage systems, stormwater drainage systems, control measures, mud tracking prevention and cleaning features and other facilities as required.

.18 The Contractor shall repair any siltation or erosion damage to adjoining surfaces and drainage facilities resulting from project activities.

.19 The Contractor shall inspect the construction control measures at least once per week and after each precipitation event of 10 mm or greater and make necessary repairs and/or cleaning, as required.

1.4 EROSION CONTROL BLANKET

.1 Erosion control blankets shall conform to Ontario Provincial Standard Specification (OPSS) 572.

.2 Erosion control blankets shall be placed over any slopes where required to ensure germination and protection of the seeded areas to the approval of the Engineer.

.3 Type and source of the erosion control blanket shall be approved by the Engineer prior to installation on-site.

1.5 SILT FENCE

.1 Install silt fences to manufacturer's installation instructions and in accordance with OPSD 219.110 or as directed in the manufacturer’s printed instructions.

.2 Remove silt fences as directed and at the conclusion of the project.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 3

CONCRETE

SECTION 02700
MISCELLANEOUS ITEMS

SECTION 02700
MISCELLANEOUS ITEMS

PART 1 GENERAL

1.1 PRESERVATION AND PROTECTION OF EXISTING WELLS

.1 Prior to the start of any site work, groundwater monitoring wells and landfill gas monitoring wells shall be fenced off with brightly coloured plastic snow fencing.

.2 The fencing shall be maintained in good repair for the duration of the work.

.3 Any wells that are damaged by the Contractor must be repaired by a licensed well technician at the expense of the Contractor.

.4 Protective fencing shall consist of brightly-coloured plastic snow fencing which shall be 1.2 m high when installed. Fencing shall be supported and attached to metal 'T' bars driven at least 0.5 m into the ground.

.5 Pay for supply, installation, maintenance and removal of snow fence to protect existing groundwater monitoring wells and landfill gas collection wells from damage by construction equipment per metre of fence installed.

1.2 CONCRETE BLOCK

.1 Supply and install 0.6m x 1m x 1m concrete blocks at the elevated drop-off area as shown on the drawings.

.2 Prepare subgrade as described in the Contract Documents and Drawings prior to placement of concrete blocks.

.3 Payment shall be made per linear meter of concrete blocks installed inclusive of all material and equipment.

1.3 PEDESTRIAN BARRICADE

.1 Supply and install pedestrian barricade in accordance with OPSD 980.101 and as shown on the drawings.

.2 Payment shall be made per linear meter of barricade installed inclusive of all material and equipment.

1.4 TOPSOIL AND SEED

.1 Topsoil separated during onsite activities shall be re-used where possible. Where additional topsoil is required, it shall be obtained from onsite stockpile.

.2 Place 150 mm thick topsoil and seed slopes of the perimeter containment berms and all areas disturbed during construction. Topsoil shall be placed in accordance with the lines and grades shown on the Construction drawings.

.3 Spread topsoil evenly. Provide a smooth, fine textured finish surface.

.4 Topsoil layer to be inspected and approved by Engineer prior to placement of plants and/or seed.

.5 Apply seed within 48 hours of placement of topsoil.

.6 The Contractor shall use seed mix (percentages noted by mass) for all areas requiring seeding as follows:

.1 30% Creeping Red Fescue

.2 27% Tall Fescue

.3 15% Perennial Ryegrass

.4 15% Timothy

.5 10% Kentucky Bluegrass

.6 3% White Clover

.7 Submit seed mix data prior to application for review by the Engineer.

.8 The tendered square metre unit price shall be compensation for placement of 150 mm thick topsoil and seeding.

1.5 RESTORATION

.1 Restore all areas disturbed by construction operations to existing conditions or better in accordance with OPSS 492. Preserve, protect and reconstruct existing facilities in accordance with OPSS 504.

.2 Contractor to provide photographic documentation of existing surface conditions in all areas affected by construction. These photographs are to be taken before and after construction to record the condition of site features. Contractor to provide City and Engineer an opportunity to be present during the photo sessions. Contractor to provide digital copies of the photographs to the City and Engineer prior to beginning any work on site. Photographs to be taken at 50 m intervals at a minimum. The photographs may be referenced when reviewing restoration requirements on site.

.3 Restore land outside limits of work, which are disturbed by work to their original condition.

1.6 ROCK EXCAVATION

.1 Large rocks and/or bedrock, if encountered during excavation, will be broken down and removed from the Work area if required. Stockpile broken down rocks on site as directed by the Engineer.

.2 Equipment and method must be approved by the Engineer prior to start of Work.

.3 Payment per square metre of rock removed will be made for, breaking down, loading, hauling, and placement of rocks on site where directed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03100
CONCRETE FORMWORK

SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.1 SCOPE

.1 This Section specifies the requirements for supply and installation of all formwork, specified herein and as required to complete the work.

1.2 REFERENCES

.1 The following is a list of standards which may be referenced in this section:

.1 American Concrete Institute (ACI): 347, Formwork for Concrete

.2 Canadian Standards Association (CSA):

.1 A23.1 Concrete Materials and Methods of Concrete Construction.

.2 S269.1 Falsework for Construction Purposes.

.3 S269.2-M Access Scaffolding for Construction Purposes.

.4 S269.3-M Concrete Formwork.

.3 National Lumber Grades Authority (NLGA): Standard Grading Rules for Canadian Lumber.

.4 Ontario Provincial Standards Specification (OPSS): 919 Formwork and Falsework.

1.3 DESIGN REQUIREMENTS

.1 Design formwork in accordance with CSA S269.1, S269.2-M, and S269.3-M to provide specified finishes. Design formwork and falsework to carry dead loads and construction live loads.

.2 When high range water reducer (superplasticizer) is used in concrete mix, design forms for full hydrostatic pressure.

.3 Make joints in forms watertight.

.4 Limit deflection of formwork to limits specified in CSA S269.3-M.

1.4 SUBMITTALS

.1 Shop Drawings:

.1 Submit formwork and falsework drawings bearing seal and signature of a Professional Engineer for record purpose.

.2 Formwork and falsework shop drawings will not be reviewed for structural adequacy.

.3 Be fully responsible for the design, construction, and maintenance of formwork and falsework.

.1 Show design criteria as specified in Clause 6.5.2 Drawing for Formwork CSA A23.1-04.

.4 Indicate design loads, materials of construction, general arrangement and dimensions and elevations.

.5 Indicate:

.1 For walls and columns on top of slabs and beams

.1 Shoring shall be left in place for at least 7 days for concrete walls and columns.

.2 Lateral bracing system.

.6 Layout of panel joints, form liners, and tie hole pattern.

.7 Shop drawing will be reviewed for general conformance only and will be used for on-site verification and record purpose.

.2 Product Data Sheets:

.1 Submit manufacturer's product data sheets including materials, allowable loading, installation, application, and maintenance instructions for:

.1 Proprietary scaffolding.

.2 Shoring beams.

.3 Lumber for formwork and falsework.

.4 Plywood for formwork and falsework.

.5 Formwork for curved surfaces.

.6 Tubular column forms.

.7 Form release agent.

.8 Form ties.

.9 Controlled permeability form liner.

.3 Samples: One each as follows:

.1 Form ties.

.2 Form liners.

.4 Informational Submittals:

.1 Statement of qualification for formwork designer.

1.5 QUALIFICATIONS

.1 Formwork, Falsework, and Shoring Designer: An Engineer licensed in the province of Ontario.

PART 2 PRODUCTS

2.1 FORM MATERIALS

.1 General:

.1 Materials:

.1 Lumber for Formwork and Falsework: Grade-marked sawn lumber graded in accordance with NLGA.

.2 Plywood for Formwork: CSA A23.1; high density overlay (plastic overlay) grade plywood. Plywood may be of lower finish grade when use in conjunction with form liner.

.3 Fibreglass or steel forms in undamaged condition, of sufficient strength and surface smoothness to produce specified finish.

.2 Circular Structures:

.1 Conform forms to circular shape of structure.

.2 Form Liners:

.1 Controlled Permeability Form Liner:

.1 Controlled pore size, maximum 0.08 mm to permit drainage of excess water; water permeability at 200 mm water head of 20 L per square metre per second.

.2 Liner must be non-compressible under wet concrete pressure.

.3 Manufacturer and Product: Frank; Zemdrain MD Type III CPF Liner.

.3 Painted Surface Forms: High density overlay plywood surfaces.

.4 Form Release Agent:

.1 Material: Release agent that does not bond with, leave residue on, stain, or adversely affect concrete surfaces, and does not impair subsequent treatments of concrete surfaces when applied to forms

.2 Freezing point minus 15 degrees C maximum.

.3 Manufacturers and Products:

.1 Master Builders, Inc.; Rheofinish.

.2 Cresset Chemical Company; Crete-Lease 20-VOC.

.3 NCA/Acrow-Richmond Ltd.; RICH-COTE.

.4 W.R. Meadows of Canada Ltd.; Sealtight Duogard.

.5 Euclid Admixture Canada, Inc.; Eucoslip VOX.

.6 Or approved equivalent products.

.5 Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

.6 Form Ties:

.1 Material: Steel.

.2 Spreader Inserts:

.1 Conical or spherical type.

.2 Design to maintain positive contact with forming material.

.3 Furnish units that will leave no metal closer than 25 mm to concrete surface when forms, inserts, and tie ends are removed.

.3 Wire ties not permitted.

.4 Flat bar ties for panel forms, furnish plastic or rubber inserts with minimum 25 mm depth and sufficient dimensions to permit patching of tie hole.

.5 Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade.

.1 Orient water stop perpendicular to tie and symmetrical about center of tie.

.2 Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

.3 Through bolt ties are not permitted for water-holding, or exterior below grade structures.

.6 Through-Bolts: Tapered minimum 25 mm diameter at smallest end.

.7 Elastic Vinyl Plug:

.1 Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length, and diameter upon removal forming watertight seal.

.2 Manufacturer and Product: Dayton/Richmond Co., A58 Sure Plug.

PART 3 EXECUTION

3.1 FORM SURFACE PREPARATION

.1 Remove water, snow, ice, laitance, curing compound, loose soil and other debris and thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants prior to coating surface.

.2 Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by the manufacturer.

.3 Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

.4 Form Liners: Provide liners with full sheets and place seams at horizontal and vertical grooves. Prepare as recommended by manufacturer.

.1 Use anchorage systems recommended by manufacturer to anchor liner to formwork.

.2 Do not use form release agent on formwork.

3.2 ERECTION

.1 General:

.1 Unless specified otherwise, follow applicable recommendations of CSA S269.1, S269.2-M and S269.3-M.

.2 Align form joints and make watertight. Keep number of joints to a minimum.

.3 Laterally brace formwork and falsework and prevent displacement during concrete placement.

.4 Form chases, openings, projections, recesses, expansion joints and construction joints.

.5 Form around pipes, mechanical, and electrical equipment which penetrate the concrete structure.

.6 Incorporate frames, castings, pipes, sleeves, and similar items into formwork.

.2 Beveled Edges (Chamfer):

.1 Form 20 mm bevels at concrete edges, unless otherwise shown.

.2 Where beveled edges on existing adjacent structures are other than 20 mm, obtain Engineer’s approval of size prior to placement of beveled edge.

.3 Wall Forms:

.1 Do not reuse forms with damaged surfaces.

.2 Locate form ties and joints in an uninterrupted uniform pattern.

.3 Inspect form surfaces prior to installation to assure conformance with specified tolerances.

.4 Do not use through-the-wall removable form ties for walls of liquid holding structures and exterior walls below grade.

.5 Where excavation shoring system is used as formwork, fasten form tie to shoring in a suitable manner to withstand applied loads.

.4 Formwork with Form Liners:

.1 Construct forms to structurally withstand deflection, movement, leakage, high hydraulic pressures resulting from rapid filling and heavy-high frequency vibration.

.2 Lay out form joints and ties in uniform pattern, unless otherwise shown.

.3 Controlled permeability form liner applications:

.1 Provide liner at all vertically formed surfaces as indicated on the Contract Drawings unless noted otherwise.

.2 Liner shall not be used at locations where capillary waterproofing is specified.

.3 Provide liners in full sheets. Place seams at regular horizontal and vertical pattern. Prepare as recommended by the manufacturer.

.4 CPF may be used a maximum of 3 times, but only where the integrity of the form liner has not been compromised.

.4 Use anchorage systems recommended by the manufacturer to anchor liner to formwork.

.5 Do not use form release agent on formwork.

.5 Forms for Curbs, Sidewalks, and Driveways:

.1 Provide standard steel or wood forms.

.2 Set forms to true lines and grades, and securely stake in position.

.6 Form Tolerances: Comply to tolerances of CSA A23.1, S269.1 and S269.3-M.

.7 Fasteners: Use only galvanized nails and fasteners when such fasteners will be left in place in the permanent structure.

.8 Shoring Under Walls or Columns:

.1 When constructing concrete walls or columns on top of slabs or beams, provide shoring under these slabs or beams to carry the total construction load.

.2 Leave shoring in place until the compressive strength of the concrete in the wall above has reached 75 percent of its 28-day compressive strength.

.9 Lateral Supports: Where required, brace walls until permanent lateral supports are in place.

.10 Formwork at Construction and Expansion Joints: Provide formwork incorporating waterstop in joint.

3.3 FORM REMOVAL

.1 Do not disturb formwork until the concrete has sufficiently set. Do not remove the struts, shoring etc. unless this portion of the concrete has reached the strength to safely support its own weight as well as the applied construction loads.

.2 Adequately shore those parts that will be subjected to additional loads during construction in order to protect them against any damage.

.3 Obtain authorization of the Engineer prior to removal of falsework.

.4 Where permitted, re-shore in accordance with ACI Standard 347. The minimum length of time that forms shall remain in place shall be:

.1 Wall forms removed – 7 days.

.2 Sides of beams – 7 days.

.3 Columns – 7 days.

END OF SECTION

SECTION 03150
CONCRETE JOINT AND ACCESSORIES

SECTION 03150
CONCRETE JOINT AND ACCESSORIES

PART 1 GENERAL

1.1 SCOPE

.1 This Section specifies requirements for the supply and installation of all expansion joints and joint material associated with concrete work and as indicated on the Contract Drawings, specified herein and as required to complete the work. It also includes protection of expansion joints for future expansion at joints, supply of labour, tools and equipment to anchor and install items to be built into/on concrete and supplied under other Sections of the Specifications.

1.2 REFERENCES

.1 The following is a list of standards which may be referenced in this section:

.1 Canadian Standards Association (CSA):

.1 A23.1-19 Concrete Materials and Methods of Concrete Construction.

.2 G30.18-09 Carbon-Steel Bars for Concrete Reinforcement

.3 G40.21-13 Structural Quality Steels.

1.3 SUBMITTALS

.1 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 locations of construction joints, including proposed construction joints in addition to those indicated on the Drawings.

.2 Joints: Expansion, Construction, and Control

.1 Submit detailed shop drawings of each joints type. Submit an elevation or section taken through the plane of the joint showing the walls and slabs at the joint.

.3 Construction and Control Joints: Layout and location for each type.

.4 Details of joint fillers, sealant, adhesives, and other appurtenances.

.2 Samples:

.1 Joint fillers.

.2 Water Stops.

.3 Expansion Joints.

.3 Product Data Sheets

.1 Submit three copies of manufacturer's product data sheets including installation, application, and maintenance instructions for:

.1 Formed PVC joint filler.

.2 Preformed joint filler.

.3 Water Stop.

.4 Control joint former.

.5 Control joint sealant.

.6 Concrete inserts.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Acceptance at Site: Verify that delivered materials are in accordance with Specifications and manufacturer's product data sheets prior to unloading and storing onsite.

.2 Storage: Store materials under tarps to protect from oil, dirt, and sunlight.

PART 2 PRODUCTS

2.1 BOND BREAKER

.1 Polyethylene tape, or coated paper

2.2 TAPE FOR JOINTS

.1 Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as joint, that will adhere to premolded joint material or concrete surface.

2.3 WATER STOP

.1 PVC waterstop by SIKA

.2

2.4 PREFORMED CONTROL JOINT

.1 One-Piece, Flexible, Polyvinyl Chloride Joint Former:

.1 Manufacturer and Product: Greenstreak Plastic Products; Style Number 854 Transverse Control Joint.

.2 Furnish in full-length, unspliced pieces.

2.5 ACCESSORIES

.1 Joint Sealants: As specified in Section 07900, Joint Sealants.

.2 Nonshrink Grout: As specified in Section 03600, Grout.

.3 Roofing Felt: CSA A123.3, Type 2, No. 30 asphalt-saturated felt.

.4 Reinforcing Steel: As specified in Section 03200, Reinforcing Steel.

.5 Nails: Galvanized, as required for securing premolded joint filler.

.6 Masking Tape: As required to temporarily adhere to concrete at each side of joint to receive filler.

.7 Galvanized Rebar at Control Joints: CAN/CSA-G30.18-M Grade 400W prior to galvanizing.

.8 Loop ferrule inserts: Inserts with plastic setting plugs; SLFW by NCA/Acrow-Richmond Ltd., or F-42 by Dayton Superior Canada Limited.

PART 3 EXECUTION

3.1 WATERSTOP INSTALLATION

.1 Follow supplier recommendation.

3.2 SETTING ANCHOR BOLTS FOR EQUIPMENT, FITTINGS AND STRUCTURAL STEEL

.1 Receive, handle, and set anchor bolts in accordance with the requirements of the trade supplying them. Protect anchor bolts after setting to maintain correct alignment and level.

3.3 ELECTRICAL CONDUITS IN SLABS AND WALLS

.1 Install conduits where required in slabs and walls in accordance with requirements of CSA A23.1[-04], Clause 6.7.5 - Conduits and Pipes Embedded in Concrete.

.2 Use of aluminum conduits is not permitted.

3.4 FRAMES FOR COVERS AND OPENINGS

.1 Set frames at locations and required elevations.

3.5 EQUIPMENT CASTINGS AND PIPE FITTINGS

.1 Set castings and pipe fittings at locations and elevations required.

3.6 REPAIR HOT-DIP GALVANIZED SURFACES

.1 Coat surfaces damaged by welding, cutting, handling during shipping or erection, or otherwise by a zinc-rich paint. Dry film thickness on repairs to exceed original coating thickness by 25% minimum.

END OF SECTION

SECTION 03200
REINFORCING STEEL

SECTION 03200
REINFORCING STEEL

PART 1 GENERAL

1.1 DESCRIPTION

.1 This Section specifies the requirements for supplying and installing all reinforcing steel and all associated accessories as indicated on the Drawings, as specified herein and as required to complete the work.

1.2 STANDARDS

.1 Reinforcing work shall be according to the requirements of the following standards:

.1 CSA-A23.3-04 “Design of Concrete Structures”.

.2 ACI Standard 315R-94 “Manual of Engineering and Placing Drawing for Reinforced Structures”.

.3 ACI Standard SP 66 “Detailing Manual - 2004”.

.4 Reinforcing Steel Institute of Canada: Reinforcement Steel Manual of Standard Practice.

1.3 SUBMITTALS

.1 Provide the Engineer with a certified copy of mill test reports showing the physical and chemical analysis of the steel to be supplied.

.2 Submit for review the layout plan and complete list of reinforcement.

.3 Clearly indicate on the shop drawings, bar sizes, spacing, location and quantities of bar reinforcement, mesh, chairs, spacers, and hangers. Mark the bars with an identifying code to permit correct placement without direct reference to the Structural Drawings.

.4 Submit reinforcing bar placement drawings prepared in accordance with Reinforcement Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.5 Indicate reinforcing bars that form part of an individual concrete placement and reinforcing bars that extends into adjacent placements.

.6 For slabs, show a separate plan indicating concrete thickness, reinforcing bars, and dowels for walls and columns cast in slab.

.7 For walls, show separate elevations indicating concrete thickness, reinforcing bars, and dowels for slabs and adjacent walls cast in wall.

.8 Do not add new information on previously reviewed shop drawings.

.9 Proceed with the substitution of different size bars to those shown on the Drawings only upon receipt of written approval by the Engineer.

.10 Dowel Bar Splicers (mechanical threaded connections) provide:

.1 Current International Conference of Building Officials (ICBO) Research Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.

.2 Verification that device threads have been tested and meet requirements for thread quality, in accordance with manufacturer's published methods.

1.4 QUALITY ASSURANCE

.1 Welder Qualifications: CSA W47.1 and CSA W186-M certified.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Ship bundles of reinforcing bars identified by tags containing bar marks along with bar list.

.2 Store materials in a manner which will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from site.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Reinforcing steel shall conform to the requirements of:

.1 CAN/CSA G30.18-M: "Billet Steel Bars for Concrete Reinforcing".

.2 Minimum elastic limit of the steel shall be 400 MPa.

.2 Mechanical Splices:

.1 Mechanical Connections: Furnish metal coupling sleeve with internal threads engaging ends of bars, capable of developing in tension or compression 125 percent of yield strength of bar.

.1 Manufacturers and Products:

.1 DB-SAE by NCA/Acrow-Richmond Ltd.

.2 Lenton Form Saver by Erico Canada Inc.

.3 D-250 Bar-Lock S/CA-Series Couplers by Dayton Superior Canada Limited.

.4 Or approved equivalent products.

.3 Dowel -in bar: Suitable for existing dowel bar splicer with rolled UNC or tapered threads as required;

.1 DI by NCA/Acrow-Richmond Ltd.

.2 Splice bar by Erico Canada Inc.

.3 D-250 Bar –Lock S/CA-Series Couplers, by Dayton Superior Canada Limited.

.4 Welded wire fabric shall conform to the requirement of CSA G30.5-1998 "Welded Wire Fabric for Concrete Reinforcing".

.5 Chairs, bolsters, bar supports and spacers shall be adequate for the strength and support of reinforcing construction conditions.

2.2 FABRICATION

.1 Fabricate reinforcing to ACI 315R-94.

.2 The Engineer will review the locations for reinforcement splices.

.3 Fabricate the reinforcing steel within the prescribed tolerances and with approved shop drawings.

PART 3 EXECUTION

3.1 PREPRATION

.1 Clean reinforcing steel prior to placing so as to remove any particle that may impede the proper bond.

3.2 PLACING

.1 Place, support and space the reinforcing in alignment to the position indicated on the Drawings.

.2 Use only non-staining, non-corrosive supports and spacers for exposed concrete surfaces.

.3 Dowel Bar Splicers:

.1 Use only in areas specifically approved in writing by the Engineer.

.2 Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICBO Research Report.

.3 Install dowel bar splicers with plastic setting plugs.

.4 Lightly grease internal threads in accordance with manufacturer's printed instructions.

.5 Maintain minimum edge distance and concrete cover.

3.3 INSPECTION

.1 The Engineer will inspect the reinforcing steel once it has been placed and will check for conformity with the shop drawings and bar lists.

.2 Notify the Engineer at least 48 hours in advance of the inspection.

.3 The concrete pour will only be authorized after the Engineer reviews the placed reinforcing steel.

.4 The Engineer's review does not relieve the Contractor of his responsibility of correctly placing and adequately supporting the reinforcing steel.

3.4 REINFORCEMENT NOT SHOWN ON DRAWINGS

.1 In addition to reinforcement shown on the Drawings, reinforce electrical conduit or other piping to be buried in concrete slabs with a 600 mm wide strip of WWF 100 mm x 100 mm – MW 13.3 before concreting.

.2 Provide additional bars required for the proper support of the reinforcement.

.3 Where no reinforcing is indicated on the Contract Drawing sections or details or specified on notes, provide minimum temperature reinforcing according to CSA CAN/CSA – A23.3.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

.1 The section specifies requirements for the supply of all labor, materials and equipment to complete concrete work as indicated on the Contract Drawings, specified herein and as required to complete the work.

.2 Comply with requirements of Canadian Standards Association (CSA) 23.1/.2 except where noted otherwise in this Specification.

.3 Comply with Division 1 – General Requirements and all other Specification Divisions except where noted otherwise in this specification.

.4 Do not use materials that are toxic in installed condition. Do not use volatile organic compounds where not permitted by law. Where use of volatile organic compounds is permitted, provide adequate ventilation and take necessary safety precautions.

.5 Section Includes

.1 Normal-density concrete.

.2 Repair of cracks and damage that develop in concrete.

1.2 REFERENCES

.1 CSA A23.1 -19 Concrete Materials and Methods of Concrete Construction.

.2 CSA A23.2 -19 Methods of Test for Concrete.

.3 CSA A3001-13 Cementitious Materials for Use in Concrete

.4 CSA A3002-13 Masonry and Mortar Cement

.5 CSA A3003-13 Chemical Test Methods for Cementitious Materials for Use in Concrete and Masonry

.6 CSA A3004-13 Physical Test Methods for Cementitious Materials for Use in Concrete and Masonry

.7 CSA A3005-13 Test Equipment and Materials for Cementitious Materials for Use in Concrete and Masonry

.8 ACI 304.2R-08 Placing Concrete by Pumping Methods.

.9 ASTM C260-10a Specifications for Air-Entraining Admixtures for Concrete.

.10 ASTM C233-14 Standard Test Method for Air-Entraining Admixtures for Concrete.

.11 ASTM C494-13 Specification for Chemical Admixtures for Concrete.

.12 ASTM C900-14 Test Method for Pullout Strength of Hardened Concrete.

.13 ASTM C1017-13 Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.14 ASTM C1074-11 Practice for Estimating Concrete Strength by the Maturity Method.

.15 ASTM C109/C109M -13 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

.16 ASTM C1610/C1610M Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique.

.17 ASTM C1611/C1611M Standard Test Method for Slump Flow of Self-Consolidating Concrete.

.18 ASTM C1621/C1621M Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Rong.

1.3 DEFINITIONS

.1 Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen when structure is drained.

.2 Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 5 mm; cracks 0.25 mm wide and larger in non-liquid holding and containment structures 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 color variations that cannot be removed by cleaning.

.3 New Concrete: Less than 60 days old.

1.4 TESTS

.1 In accordance with CSA-A23.2-14.

1.5 CONCRETE CRACK CONTROLS

.1 Place concrete in accordance with the crack control provision of CSA A23. In addition, take preventive and protective measures in proportioning, placing and curing the concrete to minimize shrinkage cracks. Such measures shall include:

.1 Do not place concrete against any surface that is less than 7°C in temperature.

.2 Restrict the concrete temperature at delivery to the forms to a maximum of 25°C.

.3 Wet down the work area, including formwork and abutting existing concrete prior to placing the concrete.

.4 Restrict pour lengths in the plan of walls to no more than 15 m. Allow a minimum of four days to elapse before placing adjacent sections. Detail the horizontal rebar to avoid continuity of the same day staggered pours.

.5 The Engineer may direct the Contractor to employ any of the means for crack control during hot weather outlined in the ACI Report and CSA standards “Hot Weather Concreting”.

1.6 SUBMITTALS

.1 Product Data Sheets

.1 Submit the manufacturer’s product data sheets including installation, application, and maintenance instructions for:

.1 Chemical admixtures.

.2 Air-entraining admixtures.

.3 Superplasticizing admixtures.

.4 Bonding agent.

.5 Repair materials.

.2 Concrete Mix Design

.1 Submit the proposed concrete mixes, aggregate grading curves, and the supplier’s applicable standard deviations at least two weeks prior to any concrete placement.

.2 Indicate contents of the cement, cementitious hydraulic slag, coarse and fine aggregate, water, water reducing and air entrainment agents, and other admixtures, air content, slump, and locations of use for each mix.

.3 Submit detailed plan for cold weather curing and protection of concrete placed and cured in weather below 5ºC.

.4 Or submit detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 25ºC.

.5 Concrete mix designs will be reviewed for conformance with requirements of the Specifications and will be returned with Engineer's comments.

.3 Source Quality Control Submittals

.1 Provide certification that source for fine, coarse and trap rock aggregates are not subject to deleterious expansion.

.2 Chemical admixtures, used in the production of concrete for potable water structures, shall be certified as safe product from recognized approving authorities

.3 Submit certification that the cement and supplementary cementing materials do not contain regulated metals and no hazardous waste derived fuels were used in the production of the cement(s).

.4 Quality Control Submittals

.1 Submit Concrete quality control plan for the project. Provide the following:

.1 Certification from concrete producer that a Professional Engineer has designed the mix based on the requirements of the Specification and that concrete mix will meet the performance requirements.

.2 Identify the Company and contact names of subcontractors, material suppliers and testing companies involved with concrete manufacture and placement.

.3 Identify concrete requirements for each element of the project.

.4 Identify all tests that will be used for material acceptance and indicate minimum specification requirements for each test.

.5 Identify the frequency of testing for each test.

.6 Identify the course of action to be taken if the testing program indicates that specification requirements have not been met.

.7 Concrete quality control plan shall not take precedence over any other Contract documents.

.8 Concrete finishers: Skilled personnel with a minimum of five years proven satisfactory experience finishing concrete of comparable size and scope.

.9 Engage manufacturers' representative for fulltime onsite supervision prior to, during, and after applications. Verify that specified products are correctly applied; amount and finishing procedures comply with manufacturer's printed instructions for project.

.2 Submit concrete delivery records.

.3 Submit a correlation curve of pullout strength test to standard cylinder strength test. Submit a correlation curve of strength of concrete at given time in hours to 56-day strength.

.5 Concrete Placing Schedule

.1 Submit a detailed concrete placing schedule, including mix by type and location of proposed pour or application.

.2 Provide notice of intent to pour a minimum of two (2) business days prior to the intended pour or application day.

.3 Provide a completed Concrete Pour Release Form (appended) prior to each pour.

.4 Do not order concrete until the Concrete Pour Release Form has been signed by the Engineer.

.6 Certificates

.1 Submit certificate of Ready Mixed Concrete Production Facilities.

.2 Submit certification that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete.

.3 Submit certification that deleterious substances in aggregate are within limits specified in CSA A23.1-19, Table 12 - Limits for Deleterious Substances and Physical Properties of Aggregates.

.4 Submit certification that proposed performance mix will produce concrete meeting the requirements of Specifications.

.5 Submit certification that proposed mix design strengths have been selected allowing for the supplier’s standard deviations as indicated in CSA A23.1-19, Clause 4.4.6 - Compressive Strength.

.6 Submit certification that bonding agent, if used, will meet the requirements of Specifications.

.7 Submit certification that crack injection/repair materials are suitable for continuous submersion.

1.7 QUALITY ASSURANCE

.1 Ready Mixed Concrete Producer: Certified member in good standing of the local Ready Mixed Concrete Association.

.2 Concrete finishers: Skilled personnel with a minimum of five years of proven satisfactory experience finishing concrete of comparable size and scope.

.3 Engage manufacturers' representative for full-time onsite supervision prior to, during, and after applications. Verify that specified products are correctly applied; amount and finishing procedures comply with the manufacturer's printed instructions for the project.

.4 Installation of new concrete finishes shall be according to the manufacturer’s recommendations and requirements.

.5 Installation of new concrete finishes shall be witnessed and approved by the manufacturer’s representative.

.6 Concrete Testing:

.1 Testing of concrete for materials and compression will be done by agencies paid for by the Owner.

.2 Pay for additional testing required because of changes in material or the mix proportions, as well as any extra testing of concrete or materials occasioned by their failure to meet the specification requirements.

.3 The use of testing services does not relieve the Contractor of his responsibility to provide materials and construction in compliance with the Drawings and Specifications.

.7 Pre-placement Meeting

.1 Hold a meeting at least four weeks prior to the initial placement of concrete to review the detailed requirements for preparing the concrete design mixes, finishes, and procedures for concrete placement for the structures.

.2 Arrange for the attendance at the meeting of the Engineer, Owner, and of concrete subcontractors, manufacturers, and suppliers including, but not limited, to the following:

.1 Contractor's superintendent.

.2 Ready-mix concrete producer.

.3 Admixture manufacturer(s).

.4 Concrete pumping and conveying equipment supplier.

.5 Concrete formwork and finishing subcontractors.

.3 Notify the Engineer at least ten (10) working days prior to the scheduled date of the meeting.

.4 The Engineer will set an agenda for the meeting at least five working days prior to the scheduled date of the meeting.

1.8 WARRANTY

.1 Any submission shall be in accordance with Section 01300 of this contract document.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Comply with 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 site.

1.10 SITE CONDITIONS

.1 Cold Weather Control Requirements:

.1 The following requirements are in addition to CSA A23.1-19, Cold Weather Concreting.

.2 Provide temperature-controlled enclosures for areas where concrete is placed whenever ambient air temperature is 5°C or lower.

.3 Protect concrete from the adverse effects of space-heated enclosures including local overheating and combustion products.

.4 Heat mix-water and, if necessary, aggregates when air temperature is at or below, or predicted to go below, 5°C at any time during the next 24 hours.

.5 Maintain temperature of reinforcing bars and forms above 10°C prior to placing concrete.

.6 Maintain temperature of concrete when deposited in forms not less than 15°C and higher than 25°C.

.7 Maintain temperature of concrete at surfaces at least 10°C for a minimum period of five days after placing and achieving minimum 75% of specified strength. Concrete temperature may then be lowered to ambient air temperature at a rate of 1/2°C per hour or 10°C per day

.8 Use additional protection if full 56-day compressive strength is required at an early age.

.9 Keep concrete continuously moist during the curing period. See section 03350 for details.

.10 The temperature difference for the concrete is being placed and the concrete being poured against is of primary importance during winter concreting. Therefore, the temperature of the surface of the previously poured concrete must be within 5°C of the concrete being placed but must not be lower than 7°C.

.2 High-Temperature Control Requirements

.1 The following requirements are in addition to CSA A23.1 -19, Hot Weather Concreting.

.2 Limit peak temperature during the curing period to 32°C maximum. Placing temperature that will satisfy this requirement depends on ambient temperature, humidity at the time of placing, thickness of the concrete, and curing methods employed.

.3 Consider use of retarders, low-heat cement, slag replacement, ice in mixing water, pre-cooling of aggregates, cooling of concrete through continuous wet curing, and similar methods in order to prevent concrete temperatures from exceeding 32°C at any time.

.4 Monitor concrete temperatures for walls and slabs 500 mm or more in thickness. After concrete temperature has peaked, control rate of cooling to ambient air temperature at a rate of 1/2°C per hour to prevent cracking.

.5 Notwithstanding requirements of subparagraphs .1 and .2 above, do not place concrete with temperature higher than 25°C. Concrete with temperature in excess of 25°C on arrival at the site will be rejected. Remove rejected concrete from the site.

.3 Concrete Protection

.1 Protect freshly placed concrete from damage due to construction operations and from cold, heat, rain, snow, running water, drying winds,

and any other circumstances which would likely cause deterioration of concrete quality.

.2 Use waterproof insulated covers or other suitable materials to enclose freshly placed concrete under these conditions.

.4 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 Do not place concrete against any surface, which is less than 7°C in temperature.

.3 The Engineer may direct the Contractor to employ any of the means for crack control during hot weather outlined in ACI Report "Hot Weather Concreting", at no additional cost to the Contract.

.4 Failure to minimize temperature differential between adjacent pours will result in temperature induced cracking. Repair such cracks as specified in this Section.

.5 Service Loads Restrictions

.1 Verify that concrete in slabs, including slabs on grade, and support components have reached specified compressive strengths before subjecting slabs to service loads.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Cements

.1 Type GU "General Use" conforming to CSA A23.1/2.

.2 Supplementary Cementing Material

.1 Cementitious hydraulic slag: CSA A3000-13 "Cementitious Materials" and comply with the following conditions and requirements:

.1 For use with Type MS cement.

.2 Maximum 25%

.2 Hydraulic slag cannot be used in the concrete mix with the slab

.3 Aggregates

.1 Normal-density Concrete

.1 Coarse aggregate: CSA A23.1; rough and angular gravel or crushed stone.

.2 Fine aggregate: CSA A23.1; natural sand.

.4 Admixtures

.1 Compatible with each other and with other concrete materials.

.2 Calcium chloride, thio-cyanates, or admixtures containing more than 0.05% chloride ions are not permitted.

.3 Air-entraining admixture: ASTM C260; non-detergent type.

.4 Water-reducing admixtures: ASTM C494; Type A.

.5 Set-retarding admixture: ASTM C494; Type B.

.6 Superplasticizing admixture: ASTM C494; Type F 1or G 2 [ASTM C1017, Type 1 or 2.]

.7 Corrosion inhibitor: ASTM C494; Type C; DCI by:

.1 W.R. Grace Co. of Canada Ltd.

.2 Rheocrete CNI by Master Builders Technologies, Ltd.

.8 Corrosion inhibitor dosage: 10 L/m^3

.5 Water: CSA A23.1; clear and free from oil, acid, alkali, organic matter, or other deleterious substances with a maximum soluble chloride ion content of 0.10% by weight.

.6 Bonding agent: Suitable for conditions of service and performance requirements of this Section.

.7 Epoxy injection resin for sealing cracks: See Section 03920 Concrete Repairs.

.8 Polyurethane injection resin for sealing cracks: See Section 03920 Concrete Repairs.

.9 Colour:

.1 Add red pigment to the new structural concrete overlay slab.

.2 Submit colour samples for approval.

.10 Self-Consolidating Concrete

.1 Portland Cement: Shall conform to ASTM C 150/C 150M, Type I.

.2 Aggregates: Fine and coarse aggregates shall conform to ASTM C 33/C 33M.

.3 Water: Shall conform to ASTM C 1602/C 1602M.

.11 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CAN/CSA A23.1.

.5 Portland cement: Type GU.

.6 Slump: 160 to 200 mm.

2.2 CONCRETE MIXES

.1 General

.1 Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete that is watertight, durable concrete with strength and other properties specified. Comply with CSA A23.1-19 Volume Stability Considerations.

.2 Use same type and brand of cement throughout.

.3 Place no concrete whose mix design has not been reviewed by the Engineer.

.4 Provide the concrete with a consistency so that the concrete can be placed satisfactorily in the forms, but the mixture shall not be so wet as to segregate during placing.

.5 In no case will it be permitted to exceed the slumps specified without the written permission of the Engineer.

.6 For the type of cementing material, use a blend of Type MS Portland Cement and cementitious hydraulic slag to a minimum of 75% Type MS Portland Cement by weight of total cementing materials content.

.7 Four test cylinders for each Type of concrete will be taken from each day's concreting or from every 100 m^3 placed whichever is the greater.

One of the cylinders will be tested at 7 days, one tested at 28 days and the other two cylinders will be tested at 56 days.

.8 The cost of the concrete required for making the above test cylinders shall be borne by the Contractor.

.9 Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1-19, Compressive Strength Requirements.

.10 Use high-slump concrete by addition of super plasticizing admixture for walls.

.11 The concrete for all slabs and walls shall be 'low-shrinkage concrete' as defined in CSA A23.1-19.

.12 Measure all aggregate by weighing. All measuring devices shall permit rapid adjustments of the mix.

.13 Source quality control

.1 Testing by an independent laboratory in accordance with CSA A23.1 and CSA A23.2, where test results less than one year are not available, to determine:

.1 Chemical composition and physical properties of aggregates.

.2 Presence and quantity of deleterious substances in aggregates.

.2 Mixes for Standard Concrete

.1 Type of Concrete (Exposure Class C-1):

.1 Type A: Concrete other than new overlay slab.

.2 Type B: Concrete for new overlay slab.

.2 Select a mix complying with the table below and submit the complete details of sieve analyses of aggregates and proportions of all ingredients by weight to the Engineer for review.

.3 Base the tender price on providing concrete with cement, water content and strength as follows:

Type of Concrete	Required Minimum Compressive Strength at 56 Days	Maximum Water-Cement Ratio	Slump (mm)	Maximum Aggregate Size (mm)
A	35 MPa	0.40	50 ± 25	19
B	35 MPa	0.40	60 ± 10	13

.1 Cementing Materials Content

.1 Except where higher quantities are needed to meet strength or other requirements, provide the following minimum cementing materials contents.

.2 320-330 kg/m^3 minimum, for nominal 20 mm to 5 mm coarse aggregate.

.2 Slump

.1 Provide slump consistent with placement, consolidation methods equipment and site conditions. Ensure concrete do not segregate during placement. Comply with CSA A23.1-19.

.2 Maximum slump before addition of the super plasticizer: 25 to 50 mm.

.3 Maximum slump after addition of the super plasticizer: 150 mm. Super plasticizer, Master Builders Pozzolith 400N and compatible with the other ingredients or approved equal.

.3 Air Content

.1 Comply with CSA A23.1-19, Table 4 - Requirements for the Air Content Categories.

.2 Provide air content Category 1, unless noted otherwise.

.3 Provide air content Category 1 for loading bays, parking areas, surge pit slab and liquid holding structures.

.4 Provide 3% maximum air content for concrete forming floors where concrete topping will be casted overtop.

.4 Admixtures

.1 All concrete shall contain an approved water reducing agent compatible with the plasticizer and conforming to ASTM C494, Type A.

.2 Provide an air entrainment agent conforming to CSA-23.1-14 compatible with the water reducing agent used.

.3 All concrete shall contain an approved shrinkage reducing admixture conforming to CSA-A23.1-19.

.4 Provide a retarding admixture to Type B concrete as/if required to allow for monolithic installation of floor topping.

.5 The admixtures shall be formulated by the manufacturer for the job area and weather conditions and shall be added to the concrete in accordance with the manufacturer's written recommendations.

.6 Except for the plasticizer, admixtures only are to be added at the plant in a liquid form.

.5 Use of Plasticizer

.1 Use of the plasticizer shall conform to CAN3-A266.6-M85 "Super-plasticizing Admixtures for Concrete".

.2 The specified plasticizer shall be added to the concrete mix for every pour.

.3 The manufacturer's instructions shall be followed regarding the storage and handling of materials, dosages, mixing and the timing of the placement.

.4 The manufacturer's representative shall attend the Site at the start of the concrete placement and provide the above-noted instructions. The representative shall be available throughout the course of the concrete work for further guidance and solution of problems that may arise during the use of the plasticizer.

.5 The approved plasticizer shall be added to the concrete mix on Site by a person knowledgeable, qualified, and experienced in the use of plasticizers.

.6 Complete and accurate records of all additions to the concrete mix shall be kept and submitted to the Engineer. Small amounts of plasticizer may be added at the plant with the written approval of the Engineer.

.3 Mix for Wall Grout

.1 Grout shall be placed on all horizontal construction joints to a minimum thickness of 75 mm and shall have a mix design conforming to the following specifications:

.1 Minimum content of cementing materials: 600 kg/m³.

.2 Coarse aggregate: None.

.3 Fine aggregate: CSA A23.1; natural sand.

.4 Water/cementing materials ratio (W/C): 0.40 maximum.

.5 Slump: Matching Type A concrete.

.6 Air content: Matching Type A concrete.

.7 Admixtures: Use water-reducing admixture.

.8 Structural concrete mix containing super plasticizing admixtures can be used in lieu of wall and column grout provided approval is obtained from the Engineer.

.4 Mix for Pumped Concrete

.1 Comply with ACI 304.2R-08, Placing concrete by pumping methods and this Specification.

.2 Fine aggregate with uniform grading curve and fineness modulus of 2.65 ±0.20.

.3 Use coarse aggregate with uniform grading curve.

.4 Super plasticizing admixture must be used for pumped concrete.

.5 Do not use bleeding promoting admixtures.

.5 Mixes for Self-Consolidating Concrete

.1 Water-to-cement ratio shall not exceed 0.40 by mass.

.2 Supplementary Cementitious Materials: The weight of SCM shall not exceed the percentages listed in the following table.

Material	Maximum percent of total cementitious materials by mass
Fly ash or other pozzolans	25
Slag cement	50
Silica Fume	10

Total of fly ash or other pozzolans and silica fume	35*
Total of fly ash or other pozzolans, slag cement and silica fume	50*

.3 Slump:

.1 Slump shall be measured in accordance with ASTM C1611/C1611M.

.2 Typical ranges in slump are outlined in the following table:

Type of Construction	Range of Slump Flow Values	
	inches	mm
Slabs	20-30	500-750
Wall, lightly reinforced	20-30	500-750
Column or wall, densely reinforced	24-30	600-750

.3 The design slump of the SCC mix shall be established after consideration of the project requirements and the Contractor's proposed location of use.

.4 The slump of SCC used on the project shall be the design slump plus or minus 50 mm.

.4 Compressive Strength: 35 MPa at 56 days.

2.3 CONSTRUCTION JOINTS

.1 Provide construction joints in the locations designated on the Drawings and where required for construction. Agree with the Engineer in writing before construction work is commenced, regarding the position of joints necessary for construction but not shown on the Drawings.

.2 Construct all joints in accordance with the details shown on the Drawings, true to line with sharp, unbroken edges.

.3 Install water stops in all construction joints and/or joints subject to liquid pressure.

.4 Place grout on all horizontal construction joints to a thickness of 75 mm before placing the concrete.

PART 3 EXECUTION

3.1 PREPARATION

.1 General

.1 Determine requirements of other trades, inform concerned trades, and assume responsibility for location, installation, and quality of items, which affect the work of this Section.

.2 Preparation of Surfaces

.1 Remove water, laitance, curing compound, wood, and other debris from surfaces on or against which new concrete will be placed.

.2 Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.

3.2 PLACING CONCRETE

.1 General

.1 No Concrete Trucks or Concrete pumps are allowed on the surge pit slab during construction.

.2 Do not commence concrete placing until sufficient manpower and equipment is available to complete the placement expeditiously preventing the formation of cold joints, and to produce specified surface finish.

.3 Provide standby equipment for critical items in case of equipment failure.

.4 Verify that cast-in-place accessories, inserts, and reinforcement are set correctly and are not disturbed during concrete placement.

.5 Place concrete on dry and clean substrate.

.6 Place concrete between expansion or construction joints in one continuous operation.

.7 Internal vibrators shall be of the high frequency type with 7000 minimum to 12000 maximum vibrations per minute when immersed in concrete.

.8 External vibrators shall have a minimum frequency of 36000 vibrations per minutes.

.9 Equipment made of aluminum material shall not come in contact with the concrete.

.10 The concrete pump shall be a reciprocating pump equipped to fit a pipeline at least 100 mm in diameter. The concrete pump and concrete trucks are not permitted on the surge pit floor slab.

.11 The mixer for the bonding agent shall be a stationary mixer, power driven, and capable of uniformly mixing the materials.

.12 Bull floats shall be commercially made of magnesium or wood.

.13 Straight edges shall be metal, 3,000 mm and 500 mm long and commercially made.

.2 Depositing

.1 Limit free drop of concrete to 1500 mm maximum in accordance with requirements of CSA A23.1-19.

.3 Time Limitations on Concrete Placement

.1 Do not use concrete after a period of one and half hours (1.5hr) has passed since first mixing of ingredients.

.2 Do not use high-slump concrete after slump falls below 100 mm for non-flowing concrete and 125 mm for flowing concrete. Where permitted, retemper in accordance with manufacturer's printed instructions. Monitor, and correct if required, air content of concrete that has been retempered.

.4 Adverse Weather Conditions

.1 Make suitable arrangements to prevent damage to fresh concrete, under adverse weather conditions.

.2 Do not allow rain, sleet, or snow to increase mixing water or damage surface finish.

.3 Plan placement frequency such that lift lines will not be visible in exposed concrete finishes.

.4 Provide windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.

.5 Do not place concrete when ambient temperature is below 5ºC or approaching 5ºC and falling, without special protection.

.6 Do not place concrete against frozen earth or ice, or against forms and reinforcement with frost or ice present.

.7 Provide heated enclosures when air temperatures are below 5ºC.

.8 Maintain surface temperature of concrete above 5ºC.

.9 Provide maximum and minimum thermometers placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work.

.10 External Heating Units:

.1 Vent heating units to atmosphere and do not locally heat or dry concrete. Where water cure is specified, maintain wet condition.

.2 Do not exhaust heater flue gases, directly into enclosed area.

.5 Wall and Column Grout

.1 Deposit 75 mm of wall and column grout evenly along horizontal construction joints in bottom of form through an elephant trunk immediately before placing wall or column concrete.

.6 Time Interval between Concrete Placements

.1 Construction Joints: Seven days wet cure continuously.

.2 Control Joints: Six days.

.3 Expansion Joints/Contraction Joints: One day.

.4 Wait at least two hours after depositing concrete in long columns and walls thicker than 200 mm before depositing concrete in beams, girders, or slabs supported thereon.

.5 For columns and walls 3 m in height or less, wait at least 45 minutes prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon

.6 Walls and columns may be placed on slabs and vice versa as soon as initial placing has sufficient strength but not sooner than 12 hours.

.7 Consolidation

.1 Consolidate the concrete during and immediately after depositing, thoroughly and uniformly by means of tamping, hand tools, finishing machines, and vibrators in order to obtain dense, watertight, homogeneous concrete well bonded to reinforcing bars.

.2 Carefully vibrate concrete around the conduits, waterstops, and gas-stops to make sure thorough contact.

.3 Bend edge of horizontal waterstops , slightly upward allowing concrete to flow under and completely fill space below the waterstop . Verify no air is trapped below waterstop and concrete is in contact with waterstop over its entire surface area.

.4 Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.

.5 Vibration consolidation not to exceed distance of 1 m from point of placement.

.8 Maximum Size of Concrete Placements:

.1 Limit 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 floor or roof system and place monolithically with floor or roof system.

.3 Should placement sequence result in cold joint located below finished water surface, install water stop in joint.

3.3 CURING

.1 Concrete curing shall be carried out immediately after finishing of the concrete surface a in accordance with CSA A23.1 and shall be maintained for a period of seven (7) days at 10 Celsius and for the time to attain 70% of the specified strength. Rate of evaporation is depending on relative humidity, concrete temperature and winds velocity; for rate of evaporation of moisture from concrete surface covered with water see CSA A23.1 Appendix D.

.2 Cure the exposed fresh concrete by covering the surface with two layers of wet burlap. On top of the wet burlap shall be plastic (polyethylene) sheets to ensure that the burlap remains wet. Strips of burlap shall overlap by at least 150 mm. New burlap shall be thoroughly soaked for 24 hours before use.

.3 The plastic sheets shall be not less than 0.10 mm (4 mils) thick, and shall be standard commercial quality, free from snags, tears or any other visible flaws, providing a tough, pliable moisture - barrier. The plastic sheets shall be lapped a minimum of 150 mm and shall be securely held in place against displacement by wind or other means. Protect concrete against vibration and loading, as far as practical, and restrict all construction traffic, until the 70% specified strength has been achieved.

.4 The burlap for curing shall conform to OPSS 1306. Moisture vapour barrier shall be white, opaque, polyethylene film, at least 100mm thick conforming to OPSS 1305.

.5 The Contractor shall ensure that the burlap is maintained in a wet condition throughout the entire curing period.

.6 Cover newly poured slabs with burlap as soon as they can be walked on and keep them continuously wet with water throughout the curing period.

.7 Loosen the formwork for walls and columns and saturate the concrete within the first 24 hours after placing.

.8 After stripping the wall forms apply a non-toxic curing compound meeting the requirements of ASTM C309. Apply the curing compound at the thickness recommended by the manufacturer after a minimum of 24 hours of moist curing. If a curing compound is not applied, continue moist curing for an additional five days.

3.4 COLD WEATHER CONCRETE

.1 In cold weather conform to the cold weather concrete provisions of CSA-A23-14, except where modified by these Specifications.

.2 The methods of protecting the concrete are to be approved by the Engineer and will be such as to prevent local drying. Open flame heaters will not be permitted.

.3 Provide suitable holes through the forms and in the concrete for the purpose of placing thermometers to determine the adequacy of heating and protection.

.4 The addition of chemicals to the concrete to prevent freezing will not be permitted.

.5 Provide in the tender price for all costs incurred in heating forms, aggregates, water, etc. during winter construction and in protecting all concrete from damage by the elements at all times.

3.5 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

.1 Propose the method of any repair to the Engineer for approval.

.2 Repair any cracks in the completed structures employing a suitable epoxy injection or gravity feed technique to make sure cracks are completely watertight after repair.

.3 Remove surface injection materials following completion of the work and finish affected areas to match the surrounding concrete.

.4 Remove and replace honeycomb or embedded debris in concrete as directed.

.5 Patch existing concrete surfaces where damaged by cutting or drilling.

.6 Any surface that needs patching up has to be inspected and approved by the Engineer before the patching work commences.

.7 Cost of all repair work to be borne by the Contractor.

3.6 CONCRETE REPAIRING AND FINISHING

.1 As soon as the face forms are removed, repair and finish the surfaces of all concrete as set out below:

.1 Repairing

.1 Cut back the metal form ties not less than 25 mm from the surface. Fill the holes with non-shrinking grout, In-Pakt as supplied by C.C. Chemicals Ltd., and then finish as specified below.

.2 Cut honeycomb and other defective areas at right angles and at least 25 mm deep.

.3 Saturate all areas to be patched with water.

.4 Fill saturated areas immediately with mortar having the same general composition as the mortar in the concrete.

.5 After completely filling the cavities, finish the concrete to match adjacent surfaces.

.2 Finishing

.1 Concrete Finish S1 (Exterior surface below finish grade)

.1 Remove all ties, bolts, nails and other metal to a depth of 25 mm and fill the holes. Chip off and rub all fins and other projections until flush with the general surface.

.2 Concrete Finish S2 (General concrete finish)

.1 Provide the concrete finish S1 plus fill with mortar all air-voids larger than 5 mm in any direction.

.3 Concrete Finish S3 (Sack-rubbed Finish)

.1 Provide the concrete finish S2 plus apply sack-rubbed finish for interior walls available for viewing.

.2 Colour match repairs on exposed surfaces by adding white Portland Cement to the mix used for patching.

.3 Where honeycombing requires repairs deeper than 50 mm use In-Pakt grout for repair and stop 15 mm back from the finished wall surface. Use Portland Cement Mortar to fill the final surface and rub the whole area with a carborundum brick.

3.7 CONCRETE FLOOR FINISHES

.1 Finish the top or final surface of all concrete by one or more of the operations of screeding, floating, trowelling, or grinding as specified by the Engineer. Dusting of the wearing surfaces with dry materials to absorb moisture or to stiffen the mix will not be permitted. Strike off floor slabs true to the required level of slopes shown on the Drawings.

.2 Protect the floor finishes from damage after placing by laying protective timbers over the areas and keeping traffic to a minimum. Should the floor be damaged, the Engineer may require the damaged portions to be cut out and replaced with a separate hardened floor finish, at no extra cost to the City.

.3 Wood Float Finish: Screed and finish with a wood float all earth-covered slabs, all walkways, and where specified. Do not start floating until some stiffening has taken place in the concrete surface.

.4 Steel Trowel Finish: Screed all floors unless otherwise specified, then finish with a wood float to present a reasonably true uniform surface and then further finish with a steel trowel.

.5 Non Slip Finish: After initial finishing, floating, and first trowelling provide nonslip surface finish by swirl-trowelling the surface in accordance with CSA A23.1, Clause 7.5.6.1 - Nonslip Surfaces. Provide nonslip swirl-trowel finish for surfaces like platforms, walkway slabs, loading docks, and the tipping floor slab.

.6 Broom Finish: After initial finishing, floating, and first trowelling, provide nonslip surface finish by brooming the surface in accordance with CSA A23.1, Clause 7.6 - Nonslip Surfaces with application of steel or fibre brooms at least 450 mm. Pull broom gently over the surface from side to side at right angles to direction of traffic, with adjacent strokes slightly overlapping. Produce a broom finish surface free from porous spots, irregularities, depressions, or rough spots with uniform corrugations less than 3 mm.

3.8 CONCRETE BONDING

.1 Horizontal Construction Joints in Reinforced Concrete Walls:

.1 Thoroughly clean and saturate surface of joint with water.

.2 Limit wall and column grout placement to 50 mm maximum thickness, 25 mm minimum thickness.

.3 Do not deposit grout from pump hoses or large concrete buckets, unless specified placement thickness can be maintained and verified through inspection windows close to joint.

.4 Limit concrete placed immediately on top of slurry concrete to 300 mm thick. Thoroughly vibrate to mix concrete and grout together.

.2 To Existing Concrete:

.1 Thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 10 mm minimum.

.2 Saturate surface with water for 24 hours prior to placing new concrete.

3.9 ABRASION RESISTANT BONDED CONCRETE FLOOR TOPPING

.1 Refer to Section 03530 Concrete Floor Toppings.

.2 The manufacturer's written instructions shall be followed regarding the storage and handling of materials, mixing, placement, finishing curing and sealing of the floor topping.

.3 The manufacturer's written instructions shall be followed for the substrate surface preparation, bonding, joints and edges.

.4 The manufacturer's written instructions shall be followed for environmental controls during all stages of surface preparation, installation finishing and curing.

.5 All work shall be completed in strict accordance to the manufacturer's full-time site representative instructions.

.6 After the preparation of the surfaces, the topping systems shall be used to build up the floor to its **final** elevations and contours.

.7 Finish the topping in accordance with Section 3.7.5 Non-slip Finish.

.8 To prevent surface cracking, cure the floor topping as soon as possible with a curing compound, approved in writing by the topping product manufacturer.

3.10 FIELD QUALITY CONTROL

.1 General

.1 Tests will be made throughout progress of the Work and will be paid for by the Owner to determine concrete quality. Tests will be in accordance with CSA A23.1 and CSA A23.2. Provide labour, concrete, and other facilities for making the test specimens.

.2 Provide and maintain facilities for storing and initial curing of test cylinders, and provide suitable crates for shipping test cylinders in accordance with CSA A23.2-14, Test Method A23.2-3C - Making and Curing Concrete Compression and Flexural Test Specimens.

.3 The testing laboratory shall provide the test results to the Owner, Engineer, Contractor and material supplier within 5 days of availability. For test that fails to meet the Specification inform Engineer, Contractor and material supplier within 48 hours.

.2 Standard Strength Tests

.1 Provide concrete for one standard strength test consisting of four cylinders for each 100 m^3 of concrete of each type placed in any day. If the amount placed, for each type of concrete is less than 100 m^3 in a day, provide concrete for one standard strength test. One cylinder will be tested at 7 days, one at 28 days and two at 56 days.

.3 Linear Shrinkage Tests

.1 Provide linear shrinkage tests for every 1,000 m^3 (maximum) of concrete used on the project to ensure conformity to approved mix designs.

.2 Provide linear shrinkage tests for any pour greater than 150 m^3 or for each construction stage.

.4 Concrete Temperature Monitoring

.1 Provide and keep in working order sufficient Taylor Instrument pocket biotherm thermometers model 6097-1 to monitor concrete temperatures in each pour.

.2 Install 12 mm diameter by 150 mm deep copper tubes crimped at bottom end into concrete at each monitoring location. Fill tube with water.

.3 Monitor concrete temperature at corners and in the centre of each concrete placement.

.5 Air Content Tests

.1 Testing agency will carry out air content tests in accordance with CSA A23.1 and CSA A23.2.

.6 Slump Tests

.1 Testing agency will carry out slump tests in accordance with CSA A23.1 and CSA A23.2.

.7 Failure to Meet Strength, Air Content, or Slump Requirements

.1 When measured slump or air content falls outside of required limits, carry out a check test immediately on another portion of the same sample. In the event of a second failure, the concrete will be considered to have failed to meet the requirements. Remove the whole batch, from which the samples were taken, off the site.

.2 When the strength requirement provisions are not met, carry out one or more of the alternatives of CSA A23.1 - Failure of Standard Cured Cylinder Test Results to Meet Requirements.

.3 When, after carrying out these requirements, there is still doubt about of the adequacy of the concrete, strengthen or replace, as directed, portions of the Work which failed to develop the required strength.

.8 Uniformity of Mixed Concrete

.1 If the results of slump, air content or density for any mix design do not comply with CSA A23.1, Table 13 - Determination of Within-Batch Uniformity, alter mixing operations and equipment until tests indicate that the requirements are satisfied.

.9 Concrete Delivery Records

.1 Submit with each batch of concrete before unloading, a typed delivery ticket prepared at the ready mix plant containing following information:

.1 Name of ready-mix batch plant.

.2 Serial number of ticket.

.3 Date and truck number.

.4 Name of the Contractor.

.5 Name of Job.

.6 Specified 56-day strength of concrete with identifying mix number.

.7 Time loaded or of first mixing of cement and aggregates.

.8 Temperature of Fresh Concrete

.10 Keep records of the time when each load arrives at the site and when discharge is completed.

END OF SECTION

CONCRETE POUR RELEASE FORM	Submission No.

PROJECT NAME -

OWNER'S PROJECT NO. –

LOCATION OF POUR .....

DATE OF POUR ..... TIME OF POUR .....

* NOTE: Consulting Engineer is to be given 24 hours notice before time of pour

1. All items of work have been completed for this pour and the following foremen have approved their work ready for inspection:

REBAR STEEL: ..... DATE :..... TIME :

MECHANICAL SLEEVE
INSERTS AND PIPING: ..... DATE :..... TIME:

ELECTRICAL SLEEVES
INSERTS AND PIPING: ..... DATE :..... TIME :

ANCHOR BOLTS AND STRUCTURAL
INSERTS:..... DATE :..... TIME :

LINE AND LEVELS: ..... DATE :..... TIME:

2. The formwork has been inspected by the formwork design engineer or his authorized designate for conformance to the formwork design.

Formwork Design Engineer DATE TIME

3. I have checked all items for this pour and request your inspection before pouring.

Contract Superintendent DATE TIME

4. The items of work have been inspected:

The pour may proceed subject to the Contractor being responsible for the work in accordance with the Contract. ☐ (Check)

or

Corrections are required as noted below ☐ (Check)

.....

Resident Supervisor DATE TIME

NECESSARY CORRECTIONS AND REMARKS:

.....

.....

SECTION 03600
GROUT

SECTION 03600
GROUT

PART 1 GENERAL

1.1 REFERENCES

.1 The following is a list of standards which may be referenced in this section

.1 American Society for Testing and Materials (ASTM):

.1 C230, Standard Specification for Flow Table Use in Tests of Hydraulic cement.

.2 C827, Standard Test Method for Change in Height at Early Ages in Cylindrical Specimens.

.3 C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).

.4 C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).

1.2 SUBMITTALS

.1 Shop Drawings:

.1 Product data of grouts including installation, application, and maintenance instructions.

.2 Proposed method for keeping existing concrete surfaces wet prior to placing hydraulic cement grout.

.3 Forming method for fluid grout placements.

.4 Curing method for grout.

.2 Quality Control Submittals:

.1 Manufacturer’s Written Instructions:

.1 Cement-water ratio of grout topping.

.2 Mixing of grout.

.3 Adding fiber reinforcing to batch.

.2 Manufacturer’s proposed training schedule for grout work.

.3 Manufacturer’s Certificate of Compliance:

.1 Grout free from chlorides and other corrosion-causing chemicals.

.2 Nonshrink hydraulic cement grout properties of Categories II and III, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.

.3 Manufacturer's Certificate of Proper Installation.

.4 Statements of Qualification: Nonshrink grout manufacturer's representative.

1.3 QUALIFICATIONS

.1 Nonshrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of 1-year experience that has resulted in successful installation of grouts similar to those for this Project.

1.4 GUARANTEE

.1 Manufacturer's Warrantee containing disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished will not be accepted.

.2 Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective due to faulty materials, as determined by industry standard test methods.

PART 2 PRODUCTS

2.1 NON-SHRINK HYDRAULIC CEMENT GROUT SCHEDULE

.1 Furnish non-shrink hydraulic cement grout for applications in grout category in the following schedule:

Application	Temperature Range	Max. Placing Time	
	4 to 38 deg C	20 min	Greater than 20 min
Filling tie holes	I	I	I
Wall extension	II	II	II
Precast joints	II	II	II
Through-bolt openings	II	II	II
Filling wall openings	II	II	II

2.2 NON-SHRINK HYDRAULIC CEMENT GROUT

.1 Category I:

.1 Non-metallic and non-gas-liberating.

.2 Pre-packaged natural aggregate grout requiring only the addition of water.

.3 Test in accordance with ASTM C1107:

.1 Flowable consistency 140 percent, five drops in 30 seconds, in accordance with ASTM C230.

.2 Flowable for 15 minutes.

.4 No bleeding of grout at maximum allowed water.

.5 Minimum strength of flowable grout, 20 MPa at 3 days, 35 MPa at 7 days, and 48 MPa at 28 days.

.6 Manufacturers and Products:

.1 Stoncor Canada; Five Star Construction Grout.

.2 Chemrex, Inc.; Set Grout.

.3 Euclid Chemical Co.; NS Grout.

.4 Or approved equivalent products.

.2 Category II:

.1 Non-metallic, non-gas-liberating.

.2 Pre-packaged natural aggregate grout requiring only the addition of water.

.3 No segregation or settlement of aggregate at fluid consistency at specified times or temperatures.

.4 Test in accordance with ASTM C939 and ASTM C1107, Grade B:

.1 Fluid consistency 20 to 30 seconds using flow cone method.

.2 Temperatures of 5, 27, and 38 degrees C.

.5 One hour after mixing, pass fluid grout through flow cone with continuous flow.

.6 Minimum strength of fluid grout, 25 MPa at 1 day, 30 MPa at 3 days, and 52 MPa at 28 days.

.7 Maintain fluid consistency when mixed in 1 to 7 m^3 loads in ready-mix truck.

.8 Manufacturers and Products:

.1 Stoncor Canada; Five Star Construction Grout.

.2 Chemrex, Inc.; Master Flow 928.

.3 Euclid Chemical Co.; Hi Flow Grout.

.4 Or approved equivalent products.

PART 3 EXECUTION

3.1 NON-SHRINK GROUT

.1 General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative's training instructions.

.2 Form Tie or Through-Bolt Holes: Provide nonshrink hydraulic cement grout, Category I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes, coordinate dry pack dense grout application with vinyl plug and bonding agent in Section 03300, CAST-IN-PLACE CONCRETE.

3.2 FIELD QUALITY CONTROL

.1 Evaluation and Acceptance of Nonshrink Hydraulic Cement Grout:

.1 Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.

.2 Perform flow cone and bleed tests, and make three 50 mm by 50 mm cubes for each cubic metre of each type of nonshrink grout used. Use restraining caps for cube.

.3 For large grout applications make three additional cubes and one more flow cone test. Include bleed test for each additional cubic metre of nonshrink grout placed.

.4 Consistency: As specified in Article Nonshrink Grout. Grout with consistencies outside range requirements will be rejected.

.5 Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates will be rejected.

.6 Tests must show that strength attained by nonshrink grout cubes is equal to or greater than minimum strength specified.

.7 Strength Test Failures: Remove and replace nonshrink grout work failing strength tests.

.8 Perform bleeding test to demonstrate grout will not bleed.

.9 Store cubes at 21 degrees C.

.10 Independent testing laboratory to prepare, store, cure and test cubes.

3.3 MANUFACTURER'S SERVICES

.1 General:

.1 Coordinate demonstrations, training sessions, and applicable site visits with grout manufacturer's representative.

.2 Provide and conduct onsite, demonstration and training sessions for all measurements, testing, application, and curing for each category and type of nonshrink grout.

.3 Ensure necessary equipment and materials are available for demonstration.

.4 Grout manufacturer's representative to train Contractor to perform grout work.

.5 Establish location at site and schedule time for grout manufacturer's demonstration and training session of proposed nonshrink grouts. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, e.g., baseplates and tie holes to provide actual on-the-job training.

.6 Training to include methods for curing grout.

END OF SECTION

SECTION 03700
UNSHRINKABLE FILL

SECTION 03700
UNSHRINKABLE FILL

PART 1 GENERAL

1.1 SECTION INTENT

.1 This Section refers to the requirements for the placing of unshrinkable fill, in underground service and utility trenches, and around structures where normal conventional backfilling and compaction cannot be performed.

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA A23.2: Test Methods and Standard Practices for Concrete.

1.3 DEFINITIONS

.1 For the purpose of this specification, the following definitions apply:

.1 Unshrinkable Fill means a mixture of aggregates, cementing material and water, with or without chemical admixtures, that hardens into a material with higher strength than soil but has 0.7 MPa compressive strength at 28 days that can be removed with hand tools.

1.4 DESIGN AND SUBMISSION REQUIREMENTS

.1 General

.1 Any required submissions shall be in writing. All submissions shall be submitted to the Contract Administrator at least three weeks prior to the beginning of the work.

.2 The requirements for submissions and design requirements are given in OPSS 1350.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Unshrinkable Fill

.1 The materials for and the production of unshrinkable fill shall be according to TS 1350 and the following:

.1 Cement type: Normal Portland GU.

.2 Maximum 28-day cylinder compressive strength: 1.0 MPa.

.3 Minimum 28-day cylinder compressive strength: 0.7 MPa.

.4 Class of exposure: N/A.

.5 Maximum nominal size of coarse aggregate: 25 mm.

.6 Minimum slump at point of discharge: 150 mm

.7 Minimum cement content: 50 kg/m³.

.2 Supplementary cementing materials, for example, fly ash, silica fume, and/or slag cement may be used to meet the requirements of this specification.

2.2 EQUIPMENT

.1 Mixing Equipment

.1 A central mixing or dry batch plant capable of accurately proportioning aggregate, cement and water shall be used according to OPSS 1350.

.2 Transport and Discharge Equipment

.1 Unshrinkable fill shall be transported to the site using ready-mix trucks.

.2 Unshrinkable fill shall be placed into the excavation using the chutes of the conveying equipment, by pumping, or with the use of buckets.

.3 Bracing and Shoring

.1 Bracing, shoring, or sheeting shall be placed to protect the services, utilities, or surrounding excavation, and shall be removed as the backfilling proceeds.

PART 3 EXECUTION

3.1 CONSTRUCTION

.1 Placing Unshrinkable Fill

.1 The material shall flow into the excavation so that it fills the entire space without vibration and segregation. Care shall be taken that no air is trapped beneath horizontal projections or in other locations in the excavation.

.2 Unshrinkable fill shall not be placed in direct contact with gas mains or plastic pipe. A layer of carefully compacted granular material shall be

placed to ensure a separation of 300 mm between the unshrinkable fill and the gas or plastic pipes.

.2 Removal of Shoring and Bracing

.1 When bracing, shoring or sheeting is used to support the sides of the excavation or to prevent movements that could damage other services or adjacent structures, this support system shall be removed as the backfilling progresses.

.3 Finishing Unshrinkable Fill

.1 The unshrinkable fill surface shall be screeded while it is still sufficiently flowable to achieve the desired grades and elevation. The surface shall be uniform and free from undulations and projections.

.4 Unshrinkable Fill Protection

.1 Where unshrinkable fill is placed, it shall be protected from vehicular traffic including construction equipment for at least 24 hours, by covering with a steel plate of sufficient strength to support the traffic during this period. The steel plates shall be countersunk to the asphalt surface with steel spikes to prevent any displacement of the plate. The steel spikes shall be hammered flush with the top of the plates and extend the full depth of the asphalt or a maximum of 150 mm. The edges of the plates shall then be ramped with HL-3F (FINE) temporary asphalt.

.2 Where vehicular traffic is not being accommodated, the backfilled excavation shall be covered with wooden planking or other protection for users of the road allowance until the unshrinkable fill can support the mass of an adult person.

3.2 QUALITY ASSURANCE

.1 Acceptance Sampling and Testing

.1 Sampling and testing shall be according to CSA A23.2. The Contractor shall assist, as necessary, in obtaining samples of unshrinkable fill for testing.

.2 The Contractor shall be responsible for the collection and disposal of the remains of all unshrinkable fill used for testing purposes.

.2 Acceptance Criteria

.1 General

.1 The compressive strength shall be the criteria for the acceptance of unshrinkable fill.

.2 Unshrinkable Fill Compressive Strength

.1 The unshrinkable fill shall be sampled and tested according to CSA A23.2.

.2 Slump testing shall be completed each time the unshrinkable fill is sampled for compressive strength according to CSA A23.2. To conform to the specified nominal minimum 28-day strength requirements:

.1 No individual strength test shall be more than 0.1 MPa above the specified strength.

.2 Compressive strength testing shall be the average of two 150 mm diameter by 300 mm long cylinder specimens (must be waxed cardboard moulds), tested at the same age.

.3 The cylinders shall only be demoulded on the same day of testing for the compressive strength to minimize handling damage to the cylinder specimens.

.3 The minimum frequency of testing requirement shall be one set of two test cylinders, per supplier, per day.

END OF SECTION

DIVISION 5

METALS

SECTION 05010
MISCELLANEOUS METALS

SECTION 05010
MISCELLANEOUS METALS

PART 1 GENERAL

1.1 DESCRIPTION

.1 This section specifies the requirements for supplying and installing metal materials including all steel support brackets as shown on the contract drawings.

1.2 FABRICATION AND WORKMANSHIP

.1 Construct miscellaneous metal items in accordance with CAN/CSA S16-19 including all current supplements.

1.3 WELDING

.1 Weld materials in compliance to the appropriate standards as follows:

.1 CSA W59-18 - Welded Steel Construction and using welders certified by Canadian Welding Bureau

.2 CSA W47.1-19 – Shop Certification

1.4 FINISH

.1 Finish members to be true to lines, free from twists, bends, open joints, sharp corners and sharp edges, to a high quality finish product.

1.5 RESPONSIBILITY FOR DIMENSIONS

.1 The general dimensions and details of the metal fabrications are shown on the Drawings where practical.

.2 Assume all responsibility for the correctness of the actual detail dimensions used in fabrication and carefully check the same, by field measurement wherever possible, in order to avoid possible errors.

.3 Variations from suggested details are subject to approval in writing by the Engineer. Such approval does not in any way waive the above-mentioned responsibility.

1.6 SUBMITTALS

.1 Submit shop drawings of all metal fabrications and details thereof for review before fabrication commences. Shop drawings shall be signed and sealed by a Professional Engineer licensed in the Province of Ontario.

.2 Do not construe the Engineers' failure to note errors, omissions or interference modifications during review of the shop drawings as approval of such errors, omissions or modifications.

.3 Submit CWB shop welding certificate and copies of CWB tickets of all site welders.

PART 2 PRODUCTS

2.1 MATERIALS (WHERE APPLICABLE)

.1 Where anchors, lifting hooks, screws, bolts, nuts, washers, hangers and other fasteners are not specifically shown or specified, provide the same having at least the strength and corrosion resistance properties of the metal fabrication for which they are required.

.2 Provide all fabrications to be constructed from materials as follows:

.1 Structural Steel Sections - CSA G40.21-M, Grade 350W.

.2 Steel - General Purpose - ASTM A36.

.3 Abrasion Resistant Plate – ASTM A514 ENDURA Weldable.

.4 Stainless Steel - Types 304, 316, 304L or 316L.

.5 Bolts for Connections - Types 304, Stainless Steel to ASTM A193 and A194 Grade 8A.

.6 Cast in Anchor Bolts - ASTM A307.

.7 Anchors in Existing Concrete - Hilti HIT-HY 200 Adhesive Anchorage System with rod anchors.

.8 Abrasion-resistant Plate:

.1 Grade: AR400F Weldable to ASTM A514.

.2 Yield Strength: 1200 MPa.

.9 Steel Plate Flashing (at push wall) - CSA G40.21-M, Grade 300W.

.10 Floor Drain Grate – Type 316 Stainless Steel.

2.2 COATINGS

.1 Following completion of fabrication of any item, grind all rough edges smooth and remove all mill scale and rust.

.2 Where noted on the drawings, galvanize all steel materials after fabrication in accordance to CSA G164. Leave galvanized surfaces clean and smooth, free of slag and other impurities. Prevent damage to galvanized surfaces during handling and installation. Refer to Section 09900-Painting for applicable finish system. All field welding to be cleaned by grinding and cold galvanized to a thickness and quality matching the original specified finish.

.3 All steel not noted on the drawings, except existing strengthened steel framing and steel liner plate of push wall, shall be paint finished. All paint-finished steelwork is to be sandblasted to SSPC SP-6 Commercial Sandblast with a surface profile of 2 mils prior to painting. Refer to Section 09900-Painting for applicable finish system. All field welding to be cleaned by grinding and touch up painted to a thickness and quality matching the original specified finish.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install all miscellaneous metal work accurately and secure properly in place.

.2 Shimming of steel members will only be permitted when approved by the consultant.

3.2 INSTALLATION OF ANCHORS, BOLTS AND LIFTING HOOKS

.1 Unless noted otherwise on the drawings, use Hilti HIT-HY 200 Adhesive Anchorage System or equivalent for fastening to existing concrete unless otherwise noted on the contract drawings.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

SECTION 05120
STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes

.1 Supply, fabrication, and erection of structural steel for the Works, including but not necessarily limited to:

.1 Rolled sections and built-up members.

.2 Hollow structural steel (HSS) sections.

.3 Structural sections for encased beam or pile construction (not applicable)

.4 Column bases and beam bearing plates.

.5 Connections and splices.

.6 Connection lugs for masonry ties welded to structural steel columns and beams. (not applicable)

.7 Steel shapes, plate separators, fasteners, anchor bolts, pipe sleeves, shims, stiffener plates, and other detail fittings necessary for the work.

.8 Bracing:

.1 Permanent members as indicated.

.2 Temporary members for construction.

.9 Shop welded shear connectors and anchor bars.

.10 Special bearings: Fixed or sliding.

.11 Alterations to existing structural steel.

.12 Surface preparation prior to shop coating.

.13 Hot-dip galvanizing of structural steel shapes, bolts, nuts, washers, and anchor bolts.

.14 Shop coating and touch-up after erection.

.15 Temporary shoring of existing construction to facilitate execution of new construction.

.16 Welding.

.2 Products Supplied But Not Installed Under The Work Of this Section (not applicable)

.1 Anchor bolts for structural steel.

.2 Embedment plates with welded anchors for structural steel.

.3 Loose lintels and shelf angles.

.3 Substitutions

.1 When deliveries of structural steel make it impossible to complete the construction on time, alternative structural sections may be accepted by the Engineer. Satisfactory proof that the specified structural shapes are not available must be produced in order to qualify for such consideration.

.2 Alternative sections shall have equal or greater factors of safety and deflections no greater than the original sections.

.3 Where dimensions of alternative sections necessitate changes in layout or design, the cost of redesign may be deducted by the City from the monies due to the Contractor.

.4 Cost of Supplementary Structural Steel

.1 Quantities of additional structural steel not included in the Contract but which will be required to complete the Contract will be calculated based on the net theoretical finished weight.

1.2 REFERENCES

.1 The “Code of Standard Practice for Structural Steel for Buildings” of the CISC shall govern this work except as otherwise noted on drawings or in specifications.

.2 The following is a list of standards which may be referenced in this Section:

.1 Canadian Standard Association (CSA):

.1 CAN/CSA-G40.20-M General Requirements for Rolled or Welded Structural Quality Steel

.2 CAN/CSA-G40.21-M Structural Quality Steels

.3 CAN/CSA-G164-M Hot Dip Galvanizing of Irregularly Shaped Articles

.4 CAN/CSA-S16-01 Limit States Design of Steel Structures

.5 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures

.6 CSA W48.1

.1 CSA W48.1-M Carbon Steel Covered Electrodes for Shielded Metal Arc Welding

.2 CSA W48.2-M Chromium and Chromium-Nickel Steel Covered Electrodes for Shielded Metal Arc Welding

.3 CSA W48.3 Low Alloy Steel Covered Electrodes for Shielded Metal Arc Welding

.4 CSA W48.4 Solid Carbon Steel Filler Metals for Gas Shielded Arc Welding

.5 CSA W48.5-M Carbon Steel Electrodes for Flux- and Metal-Cored Arc Welding

.6 CSA W48.6 Fluxes and Carbon Steel Electrodes for Submerged Arc Welding

.7 CSA W59-M Welded Steel Construction (Metal Arc Welding)

.8 CAN/CGSB-1.181 Ready-Mixed Organic Zinc-Rich Coating

.2 ASTM International (ASTM):

.1 A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Steel Piling

.2 A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

.3 A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.4 A143, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement

.5 A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.6 A325, Standard Specification for High-Strength Bolts for Structural Steel Joints

.7 A384, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies

.8 A385, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

.9 A490, Standard Specification for Heat-Treated Steel Structural bolts, 150 ksi Minimum Tensile Strength

.10 A563, Standard Specification for Carbon and Alloy Steel Nuts

.11 A572, Standard Specification for High-Strength Low Alloy Columbium-Vanadium Structural Steel

.12 A588, Standard Specification for High-Strength Low Alloy Structural Steel With 50 ksi Minimum Yield Point to 4 in. Thick

.13 A673, Standard Specification for Sampling Procedure for Impact Testing of Structural Steel

.14 A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

.15 A992, Standard Specification for Steel for Structural Shapes for Use in Building Frames

.16 B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

.17 F436, Standard Specification for Hardened Steel Washers

.18 F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

.3 American Welding Society (AWS): D1.1, Structural Welding Code-Steel

.4 The Society for Protective Coatings- SSPC-SP10

1.3 DESIGN REQUIREMENTS

.1 Connections – General

.1 Design in accordance with CAN/CSA-S16, Clause 21. - Connections.

.2 Connections may be bolted or welded

.3 For structural steel encased in masonry, design connection system so that it is totally concealed within the masonry.

.4 For openings, including but not limited to doors and windows, design connection system so that it does not encroach into clear opening.

.5 Where connection details are shown on drawings, conform to the drawing as a minimum.

.6 Design connections for end reactions from torsion, bending moment, shear, and axial load where indicated. Use standard connections as per CISC Handbook where possible.

.7 Where no end reaction is indicated, design connection on the basis of simple construction for the end reaction of a laterally supported beam of a given span under a uniformly distributed factored load that has attained its maximum moment capacity in accordance with Standardized Shear Connections published by Canadian Institute of Steel Construction (CISC).

.8 For beams with intersecting bracing members design connections for beam reaction plus reaction from the bracing members.

.9 For non-standard connections, submit signed and stamped sketches and design calculations prepared by a Professional Engineer registered in the Province of Ontario.

.2 Bolted Connections

.1 Unless noted otherwise, use bearing-type connections with snug-tightened bolts. Minimum 2 M20 – ASTM-A325M/A490M bolt connections.

.2 Where indicated, use slip-critical connections.

.3 Use high-strength bolts in accordance with CAN/CSA-S16, Clause 22. – Design and Detailing of Bolted Connection.

.4 Use pre-tensioned bolts in accordance with CAN/CSA-S16, Clause 22.2.2 – Connections Using Pre-tensioned High-Strength Bolts for:

.1 Slip-critical connections.

.2 Connections of members resisting crane loads.

.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.

.5 Use clipped double angle connections where beams of similar size are bolted to both sides of a column at a common location.

.3 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 50 percent of strength of the member, in tension or compression, whichever governs.

.4 Design splices for the full strength of the member in torsion, bending, shear, and axial load unless noted otherwise.

.5 Provide pair of bearing stiffeners on beams and girders at point of concentrated loads, such as at columns, monorail beams, and equipment supports.

1.4 SUBMITTALS

.1 Action Submittals:

.1 Provide Shop Drawing details showing:

.1 Submit shop drawings, connection design, erection diagrams and erection procedures based on actual field conditions, field measured by the Contractor.

.2 All shop drawings shall be submitted bearing the signed and dated seal of a professional engineering licensed in the Province of Ontario.

.3 Submit copies of shop and erection drawings to the inspection and testing company for their information.

.4 Indicate fabrication details including cuts, copes, connections, bolt tension, holes, bearing plates, threaded fasteners, shop coatings, galvanizing, or other surface treatments, and welds on shop details. Indicate welds using American Welding Society (AWS) welding symbols in accordance with ANSI/AWS A2.4.

.5 On erection diagrams, mark each member with a number corresponding to the drawing containing the shop details of the member.

.6 Submit shop details and erection diagrams together for each structure or part of structure in accordance with CAN/CSA S16.1.

.7 Shop drawings will be reviewed for general arrangement and material specifications.

.8 Shop drawings bearing seal and signature of a Professional Engineer registered in the Province of Ontario will not be reviewed for structural adequacy.

.9 Dimension shop drawings in S.I. metric units.

.2 Informational Submittals:

.1 Mill Certificates of tests made in accordance with ASTM A6.

.2 Direct Tension Indicators (DTIs): Furnish manufacturer's test report meeting requirements of ASTM F959.

.3 Tension Control (TC) Bolts: Furnish manufacturer's test report meeting requirements of ASTM A325 and ASTM F1852.

.3 Certificates

.1 Submit two (2) copies of steel producer certificates in accordance with CAN/CSA-G40.20-M.

.2 Submit an affidavit stating that connections designed on the basis of simple construction are in accordance with Standardized Shear Connections published by CISC.

.3 Submit an affidavit stating that the materials and products used in fabrication are in accordance with the applicable material and product Standards.

.4 Submit welding certificate in accordance with CSA W47.1.

.5 Submit certification of compliance for hot-dip galvanizing in accordance with CAN/CSA-G164-M.

1.5 QUALITY ASSURANCE

.1 Identification:

.1 Marking:

.1 Heat number, producer's name or brand mark materials to comply with CAN/CSA-G40.20-M.

.2 For member identification do not use die stamping.

.3 Shop mark all members for fit and match.

.4 If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.5 Mark galvanized materials with a stamp or wire-on tag indicating the name of the galvanizer, the applicable code, and the weight of zinc coating.

.2 Welding Qualifications: Perform welding only by a fabricator certified under the CSA qualification code W47.1-(latest edition) and in accordance to CAN/CSA W59. Execute work of this Section only by a structural steel fabricator who is fully accredited and is a current member of the Canadian Institute of Steel Construction, or who has received approval in writing from the Engineer no less than (1) week before tender closing.

.3 Only specially trained personnel to install shear studs.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Delivery: 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.

.2 Storage:

.1 Protect structural steel members and packed materials from corrosion and deterioration.

.2 Store in dry area and not in direct contact with ground.

.3 Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.

.3 Handle materials to avoid distortion or damage to members or supporting structures.

.4 Provide delivery schedules seven (7) days prior to shipping.

.5 Store structural steel materials on wood blocking so that no portion of steel comes into contact with ground. Cover and protect steel from snow, rain, and ground splatter.

.6 Use nylon or padded cables for handling galvanized steel.

1.7 SITE CONDITIONS

.1 Field Measurements

.1 Verify dimensions on site.

.2 Promptly notify the Engineer if apparent discrepancies are found.

.2 Existing Conditions

.1 If Work includes alterations or modifications to existing steelwork, or connecting new steelwork to existing steelwork or other existing work, arrange with the City to visit the proposed work site during the tendering period to review existing conditions including access and interference with existing installations.

.2 Take full responsibility for doing work under the given existing conditions including any temporary work such as shoring and underpinning, which may be required in order to execute construction of the permanent Works.

.3 Protection of Existing Equipment and Services

.1 Where structural steel will be installed in close proximity to and around existing equipment, building services and utilities, the Contractor shall protect the existing equipment and take precautions necessary to prevent damage to it.

.4 Coordinate work under this Section with work to be done and equipment to be supplied under other Sections.

PART 2 PRODUCTS

2.1 MATERIALS

.1 W-Shapes:

.1 CAN/CSA-G40.21-M Grade 350W.

.2 Shapes Except W-Shapes, Rolled plates and bars:

.1 CAN/CSA-G40.21-M Grade 300W.

.3 For finishing and coating materials, see Section 09960 – High Performance Coatings.

2.2 FASTENERS

.1 Anchor Rods: As specified in Section 05550 – Anchorage in Concrete and Masonry.

.2 High-Strength Bolts: ASTM A325 or ASTM A490, bolt type.

.3 Nuts: ASTM A563, type to match bolt type and finish.

.4 Hardened Steel Flat and Beveled Washers: ASTM F436, type to match bolt finish.

.5 Plastic or metal void forms: Wilson Anchor Bolt Sleeve by NCA/Acrow-Richmond Ltd. or D-1-S Anchor Bolt Sleeve by Dayton Superior Canada Limited.

.6 Headed stud anchors: ASTM A108; Headed shear stud connectors by Continental Studwelding Ltd. or TRW Canada Ltd.

.7 Deformed bar anchors: ASTM A496; Deformed bar anchor by Continental Studwelding Ltd. or TRW Canada Ltd.

.8 Zinc-rich primer for repair of galvanized surfaces: CAN/CGSB-1.181; Sealtight Galvafroid Zinc-Rich Coating by W.R. Meadows Ltd. or Z.R.C. Cold Galvanizing Compound supplied by Kerry Industries Limited.

.9 Welding electrodes: CSA-W48 Series; Low hydrogen E480 series.

2.3 ANCILLARY MATERIALS

.1 Shop paint primer: To meet the requirements of CICS/CPMA standard 2-27 except that:

.1 Surface preparation to be commercial sandblasting to SSPC SP-6.

.2 Refer to Section 09900 - Painting for applicable finish system.

.3 Primer under fireproofing shall refer to Section 07811-Applied Fireproofing.

.2 Grout: As specified in Section 03600 - Grout.

2.4 FABRICATION

.1 General:

.1 Fabricate as shown and coordinate with work of all other sections in accordance with CAN/CSA-S16 and CISC Code of Standard Practice for Structural Steel Buildings and Bridges.

.2 Mark and match mark materials for field assembly.

.3 Complete assembly, including bolting and welding of units, before start of finishing operations.

.4 Field measure before fabrication.

.2 Welding

.1 Weld in accordance with CSA W59-M. Comply with dimensional tolerances of CSA W59-M and ANSI/AWS D1.1.

.2 Shop weld unless noted otherwise.

.3 Apply for acceptance of supplementary welding.

.4 Do not weld at locations where weld is not specified.

.5 Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

.3 Shop Installed Shear Connectors

.1 Install headed shear stud connectors in accordance with following requirements:

.1 The steel surface, to which stud is welded, is free of loose mill scale, heavy rust or paint.

.2 Space studs evenly over full length of member unless noted otherwise.

.4 Connections:

.1 Shop Connections: Weld or bolt.

.2 Meet requirements of CAN/CSA-S16.

.3 Meet OSHA requirements for one independent bolt at beams framing in to column web connections.

.5 Interface With Other Work:

.1 Holes:

.1 As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.

.2 No flame-cut holes will be permitted without prior approval of Engineer.

.2 Weld threaded nuts to framing, and other specialty items where shown or required to receive other Work.

.3 All open ends are to be capped with 6 mm plate, fully welded and ground smooth.

.6 Finish

.1 Finish members true to line, free from twists, bends, open joints, sharp corners and sharp edges.

.2 Weld and fabricate structural steel members which are permanently exposed at the exterior of the completed structures, such as lintel plates

and built-up members, and interior members exposed in architecturally finished areas, such as door frames, cover plates, and similar items, in accordance with the following requirements:

.1 Clean appearance.

.2 Snug fit between parts composing built-up members.

.3 Continuous welds ground smooth.

.7 Fabrication Tolerances

.1 Allowable tolerance for bolt holes:

.1 Match bolt holes so that a gauge with a diameter matching the nominal diameter of the fastener will pass freely through the assembled members at right angles to such members.

.2 Finish holes a maximum of 2 mm in diameter larger than diameter of bolt in accordance with CAN/CSA-S16.1, Clause 28. Holes for Bolts or Other Mechanical Fasteners, unless noted otherwise.

.3 Limit centre-to-centre distance between two adjacent holes a maximum of 1 mm from dimensioned distance between such holes.

.4 Limit centre-to-centre distance between any groups of holes to the following:

Centre-to-Centre Distance (Metres)	Tolerance ± (mm)
Less than 10	1
10 to 20	2
Greater than 20	3

.2 Do not correct mispunched or misdrilled members. Apply for permission of corrective measures.

.8 Shop Paint Primer:

.1 Do not shop prime the following surfaces, unless indicated otherwise:

.1 Faying surfaces of slip critical bolted connections.

.2 Within 50 mm of field-welded connections.

.3 Steel members to be completely encased in reinforced concrete.

.2 Surface to receive finish top coats or paint, one coat of prime paint. Apply shop primer to top flange surfaces of composite steel beams unless indicated otherwise.

.3 Shop primer for steel members to be coated with fireproofing material shall be compatible with fireproofing as specified.

.9 Hot-dip Galvanizing

.1 Galvanize structural steel where noted in accordance with CAN/CSA-G164-M – min. G600 coating designation (600g/m2) unless noted otherwise.

.2 Galvanize bolts, nuts, washers, and anchor bolts for connections to galvanized steel in accordance with CAN/CSA-G164-M.

.3 Complete fabrication, and prepare surfaces of steel by removing rust, weld spatter, flux and residue, burrs, and surface defects before galvanizing.

.4 Tap threads of nuts after galvanizing.

.10 Finish Coating

.1 Paint or high-performance coating for steel members in accordance with Section 09900 – Painting and Section 09960 – High Performance Coatings.

PART 3 EXECUTION

3.1 ERECTION

.1 Meet requirements of CAN/CSA S16 and CISC Code of Standard Practice for Structural Steel.

.2 Install Contractor's designed temporary construction bracing to provide necessary support until components are in place and construction is complete. Failure to make adequate provision for erection shall be the sole responsibility of the Contractor.

.3 High-Strength Bolted Connections:

.1 Tighten in accordance with CAN/CSA S16 Clause 23 Installation and Inspection of Bolted Joints.

.2 Tighten pretensioned bolts, where noted, in accordance with CAN/CSA-S16.1Clause 23.8.

.3 Do not reuse bolts that have undergone tightening and loosening more than two (2) times. Replace such bolts with new ones.

.4 Hardened Washers:

.1 Provide at locations required by use of washers section of CAN/CSA S16, to include slip critical connections using slotted or oversized holes or A490 bolts.

.2 Use beveled style and extra thickness where required by CISC Specification.

.3 Use square or rectangular beveled washers at inner flange surfaces of Canadian Standard beams and channels.

.4 Do not substitute DTIs for hardened flat washers required at slotted and oversize holes.

.5 Install galvanized washer under bolt head and nut when using galvanized bolts.

.5 For bearing-type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.

.4 Fully Tensioned Bolted Connections:

.1 Use DTIs or TC bolts at slip critical (SC) and fully tensioned (FT) bearing-type connections.

.2 DTIs:

.1 Position within bolted assembly in accordance with ASTM F959.

.2 Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until plies are in firm contact and fasteners are uniformly snug tight.

.3 Final tighten bolts, beginning at most rigid part of bolted connection and progressing toward free edges, until final twist-off of TC bolts or until DTIs have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

.5 Field Welding

.1 Fit parts together true to line and level.

.2 In cold weather, preheat parts prior to welding.

.6 Field Splicing

.1 Provide adequate temporary supports for continuous members, which are spliced in the field to prevent erection stresses from being built into the member(s).

.7 Anchor Bolts

.1 Provide anchor bolts for beams, columns, joists, and other similar items.

.2 Include the necessary setting templates and instructions for accurate installation.

.3 Where bolts are installed by another trade, provide supervision during installation.

.4 Tighten anchor bolts to a snug-tight condition.

.8 Alterations in the Field of Shop Fabricated Members

.1 Do not alter or cut structural members in the field without written permission.

.9 Plumbing of Steel Frame

.1 After framing members are in place, plumb up the steel work accurately.

.2 Complete permanent connections including bracing connections and field constructed moment connections.

.3 Weld permanent diaphragms in place where applicable.

.10 Shimming and Grouting of Base Plates

.1 Shim base plates and adjust steel members to proper level.

.2 Use plastic shims of bearing area as required to carry safely the imposed erection loads.

.3 Verify that grouting under base plates is finished after completion of structural steel erection.

.11 Touch-up damaged primed surfaces at completion of erection with shop paint primer.

.12 Repair hot-dip galvanized surfaces damaged by welding, cutting, handling during shipping or erection, or otherwise, in accordance with ASTM A780 using a zinc-rich coating. Dry film thickness on repairs to exceed original coating thickness by 25% minimum.

3.2 SETTING BASES AND BEARING PLATES

.1 Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces.

.2 Clean bottom surface of base and bearing plates.

.3 Set loose and attached baseplates and bearing plates for structural members on wedges, shims, leveling nuts, or other adjustable devices. Use leveling plates where indicated.

.4 Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to placing grout. Weld plate washers to base plates where indicated.

.5 Grout Under Baseplates: As specified in Section 03600, Grout, prior to placing loads on structure.

3.3 FIELD ASSEMBLY

.1 Set structural frames accurately to lines and elevations shown.

.2 Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.

.3 Align and adjust various members forming a part of a complete frame or structure before permanently fastening.

.4 Level and plumb individual members of structure within tolerances shown in CAN/CSA S16 Clause 29.7 Erection Tolerances.

.5 Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.

.6 Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.

.7 Splice members only where indicated and accepted on shop drawings.

3.4 MISFITS BOLTED CONNECTIONS

.1 Where misfits in erection bolting are encountered, immediately notify Engineer for approval of one of the following methods of correction:

.1 Ream holes that must be enlarged to admit bolts and use oversized bolts.

.2 Plug weld misaligned holes and redrill holes to admit standard size bolts.

.3 Drill additional holes in connection, conforming with CSA Standards for bolt spacing and end and edge distances, and add additional bolts.

.4 Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.

.2 Do not enlarge incorrectly sized or misaligned holes in members by burning or by use of drift pins.

3.5 MISFITS ANCHOR BOLTS

.1 Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.

.2 Do not flame cut to enlarge holes without prior approval of Engineer.

3.6 GAS CUTTING

.1 Do not use gas cutting torches in field for correcting fabrication errors in structural framing.

.2 Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by Engineer.

.3 Finish flame-cut sections equivalent to sheared and punched appearance.

3.7 REPAIR AND CLEANING

.1 Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.

.2 Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.

.3 Remove weld back-up bars and grind smooth.

.4 Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application.

3.8 FIELD QUALITY CONTROL

.1 Materials and fabrication will be subjected to inspection by a testing agency retained by the City. This will in no way affect the Contractor's responsibility regarding the provision of work that fully complies with the specifications.

.2 Advise the Engineer sufficiently in advance of operations to allow for assignment of personnel for shop and field inspection of material, workmanship, erection,

tolerances, and connections. Provide facilities to enable inspection to be carried out.

.3 Inspection of field welded and bolted connections will be done by a testing agency paid for by the City.

.4 The inspection does not relieve the Contractor of his responsibility to supply materials and construction in compliance with the Drawings and Specifications.

.5 High-Strength Bolted Connections:

.1 An independent testing agency will be retained by City to perform the following inspection and testing in accordance with CAN/CSA S16:

.1 Marking identification and conformance to ASTM standards.

.2 Alignment of bolt holes.

.3 Placement, type, and thickness of hardened washers.

.4 Tightening of bolts.

.2 Bearing-Type Connections Not Fully Tensioned (N, X): Snug tight condition with plies of joint in firm contact.

.3 Fully Tensioned (FT) Bearing and Slip Critical (SC) Connections:

.1 Conduct preinstallation test.

.2 Monitor installation and tightening of DTIs or TC bolts.

.3 Monitor condition of faying surfaces for slip critical connections.

.4 Preinstallation Test:

.1 Conduct jobsite test prior to start of work using a bolt tension measuring device.

.2 Select representative sample of not less than three bolts of each diameter, length, and grade.

.3 Include DTIs and flat hardened washers as required to match actual connection assembly.

.4 Conduct test in accordance with Specification for Structural Joints Using ASTM A325 or A490 Bolts.

.5 Nondestructive Testing (NDT) Report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.

.6 Defective Connections: Correct and re-inspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.

.6 Welded Connections:

.1 An independent testing agency will be retained by City to perform the following inspection and testing of field welds.

.1 Groove Welds:

.1 Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.

.2 Use RT only for butt joint groove welds.

.2 Fillet Welds Larger Than 8 mm: Liquid penetrant (PT) or magnetic particle (MT) for 10 percent of randomly selected welds, unless otherwise indicated.

.3 All Welds: 100 percent visually inspected (VT).

.7 Repair and retest defective welds as specified in accordance with CAN/CSA W59 Shall be on the contractor’s expense.

END OF SECTION

SECTION 05550
ANCHORAGE IN CONCRETE

SECTION 05550
ANCHORAGE IN CONCRETE

PART 1 GENERAL

1.1 SECTION INTENT

.1 This section refers to the procurement and installation of anchors in concrete and masonry. It includes cast-in-place anchor bolts, adhesive anchors, expansion anchors, and epoxy-grouted anchor bolts specified herein and as required to complete the work.

1.2 GENERAL

.1 Unless otherwise specified or indicated on the drawings, all anchors and anchor bolts shall be cast-in-place anchor bolts with forged heads or embedded nuts and washers. Unless otherwise indicated, bolts in concrete shall have a diameter of at least 20 mm, and bolts in grouted masonry shall have a diameter of at least 13 mm.

.2 Unless otherwise indicated on the drawings, anchors and anchor bolts used in the following locations and applications shall be of the indicated materials. Other anchors and anchor bolts shall be as indicated on the drawings. Where stainless steel is indicated, use Type 316 stainless steel.

.1 Cast-in-Place Anchor Bolts:

.1 Submerged locations: Stainless steel.

.2 Locations subject to splashing: Stainless steel.

.3 Buried locations: Stainless steel.

.4 Anchorage of structural steel columns: Galvanized steel.

.5 Other exterior locations: Galvanized steel.

.6 Other interior locations: Carbon steel.

.2 Threaded Rod and Expansion Anchors:

.1 Submerged locations: Stainless steel.

.2 Locations subject to splashing: Stainless steel.

.3 Buried locations: Stainless steel.

.4 Anchorage of structural steel columns: Stainless steel.

.5 Other exterior locations: Stainless steel.

.6 Other interior locations: Carbon steel.

.3 Adhesive anchors and expansion anchors may be used instead of cast-in-place anchors where specifically indicated or permitted on the drawings or with the specific acceptance by the Consultant.

1.3 SUBMITTALS

.1 Letters of certification indicating the manufacturer and types of adhesive anchors, expansion anchors and epoxy grouts to be supplied shall be submitted in accordance with Section 01330 – Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Materials shall be handled, transported and delivered in a manner that will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Materials shall be as indicated below:

.1 Expansion Anchors: Hilti "Kwik-Bolt"; ITW Ramset/Red Head "Trubolt Wedge Anchor"; Powers Fasteners "Power-Stud Anchor".

.2 Anchor Bolts and Nuts:

.1 Carbon Steel: American Society of Testing and Materials (ASTM) A307 or grade 300 rod, with compatible nuts.

.2 Stainless Steel: Bolts, ASTM F593-02e.2, Alloy Group 2 (316 SS); nuts, ASTM F594, Alloy Group 2.

.3 Galvanized Steel: Carbon steel bolts and nuts; hot-dipped galvanized, ASTM A153/A153M-05 and ASTM A385-05.

.4 Flat Washers: American Nation Standards Institute (ANSI) B18.22.1; of same material as anchor bolts and nuts.

.3 Threaded Rod Anchors and Nuts:

.1 Carbon Steel: Grade 300W rod, with compatible nuts.

.2 Stainless Steel: Rods, ASTM F593, Alloy Group 2 (316 SS); nuts, ASTM F594-02, Alloy Group 2.

.3 Galvanized Steel: Carbon steel rods and nuts; hot-dipped galvanized, ASTM A153 and ASTM A385-05.

.4 Adhesive Anchors for Concrete and Grout Filled Masonry:

.1 Threaded Rods and Nuts: As specified for Threaded Rod Anchors and Nuts and as recommended by the adhesive manufacturer.

.2 Adhesive: Hilti "HIT HY 150 MAX-SD", "HIT HY 150 MAX", "HIT-ICE", "HIT RE500", or "HVA" Systems.

.5 Epoxy Grout for Reinforcing Bars, Threaded Rod Anchors and Anchor Bolts:

.1 Adhesive for Floors and Horizontal Surfaces: Sika "Sikadur 35, Hi-Mod LV"; ChemRex "Concresive Liquid LPL"; Sika "Sikadur 32 Hi-Mod", Hilti "HIT RE500".

.2 Adhesive for Vertical Surfaces and Overhead Applications: Sika "Sikadur 31 Hi-Mod Gel".

.3 Aggregate: As recommended by the epoxy grout manufacturer.

.4 Water: Clean and free from deleterious substances.

.6 Adhesive Anchors for Hollow Masonry System:

.1 Threaded Rod Anchors and Nuts: As specified for Threaded Rod Anchors and Nuts and as recommended by the adhesive manufacturer.

.2 Adhesive: Hilti "HIT HY 20" System; ITW Ramset/Redhead "Epcon Ceramic 6" System.

.3 Screen Tubes: As recommended by the manufacturer.

2.2 ANCHORS

.1 Cast-in-Place Anchor Bolts: Cast-in-place anchor bolts shall be delivered in time to permit setting before the structural concrete is placed. Anchor bolts shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-place anchor bolts indicated on the drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts without locknuts.

.2 Adhesive and Expansion Anchors: When adhesive or expansion anchors are indicated on the drawings, only acceptable systems shall be used. Acceptable systems shall include only those systems and products specified or specifically indicated by product name on the drawings. Alternative anchoring systems may be used only when specifically accepted by Consultant. An acceptable adhesive anchor system may be used as an alternative in locations where epoxy grouted anchor bolts and epoxy grouted threaded rod anchors are specified or indicated.

.1 Threaded rod anchors in adhesive anchor systems shall be furnished with a sufficient length to provide an embedment depth of at least 15 rod diameters and free of coatings that would weaken the bond with the adhesive. Unless otherwise required, single nut and washer shall be furnished for threaded rod anchors, adhesive anchors and expansion anchors. Anchor bolts and threaded rod anchors that are to be epoxy grouted shall be clean and free of coatings that would weaken the bond with the epoxy.

.2 Adhesive anchors in hollow masonry shall utilize screen tubes as recommended by the manufacturer.

.3 Epoxy Grouted Anchor Bolts and Reinforcing: Epoxy grout for installing reinforcing steel dowels and anchor bolts not indicated to be adhesive anchors shall consist of a two-component liquid epoxy adhesive of viscosity appropriate to the location and application and an inert aggregate filler component, if recommended by the adhesive manufacturer. Components shall be packaged separately at the factory and mixed immediately before use.

PART 3 EXECUTION

3.1 PREPARATION

.1 Prior to the erection of the formwork, verify all the dimensions and locations for the anchor bolts.

3.2 GENERAL

.1 Anchor bolts shall be installed at the locations indicated on the drawings.

.2 Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before final installation and tightening of the nuts.

.3 Anchors shall be located at least 100 mm away from conduits, sleeves and drains bodies at their largest point measured on top of the slab above the anchor, and the like, embedded in the concrete.

.4 Anchors shall be installed in drilled holes with a minimum depth and diameter specified by the manufacturer unless noted otherwise.

.5 If, when drilling the holes for the anchors, reinforcement is encountered and the hole must be shifted to clear the reinforcement, the abandoned hole shall be patched with non-shrink grout of similar properties as the base concrete.

3.3 CAST-IN-PLACE ANCHORS AND ANCHOR BOLTS

.1 Cast-in-place anchors and anchor bolts shall be carefully positioned with templates and secured in the forms prior to placing concrete.

.2 Contractor shall verify that anchorage devices are positioned in accordance with the design drawings and with applicable equipment submittal and Approved Shop Drawings.

.3 Anchors and bolts shall be positioned sufficiently in advance of the concrete placement so that an on-site representative of Consultant or Waste Management of Canada Corporation (WMC) will have sufficient time to inspect the bolts prior to placing concrete. If special inspection of the anchor bolts is required by the local building code, anchorage shall be placed in sufficient time and with sufficient notification so that such inspection can take place without delaying progress of the work.

.4 Threads, bolts and nuts spattered with concrete during placement shall be cleaned prior to final installation of the bolts and nuts.

3.4 EPOXY GROUT

.1 Epoxy grout components shall be packaged separately at the factory and shall be mixed immediately before use. Proportioning and mixing of the components shall be done in accordance with the manufacturer's recommendations.

.2 An acceptable adhesive anchoring system may be used where epoxy grouted threaded rod anchors are indicated on the drawings.

.3 Preparation: Where indicated on the drawings, anchor bolts, threaded rod anchors and reinforcing bars shall be epoxy grouted in holes drilled into hardened concrete. Diameters of holes shall be as follows:

Item	Diameter of Hole
Reinforcing Bars and Threaded Rod Anchors	3mm larger than the outside diameter of the bar or the rod
Headed Anchor Bolts	Bolt diameter plus 50mm and sufficient to clear the bolt head.

.4 The embedment depth for epoxy grouted anchor bolts, threaded rod anchors and reinforcing bars shall be at least 15 bolt, rod or bar diameters, unless otherwise indicated on the drawings.

.5 Holes shall be prepared for grouting as recommended by the epoxy grout manufacturer.

.6 Installation: Anchor bolts, threaded rod anchors and reinforcing bars shall be clean, dry and free of grease and other foreign matter when installed. The bolts, rods and bars shall be set and positioned and the epoxy grout shall be placed and finished in accordance with the recommendations of the grout manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with epoxy grout, without voids.

3.5 ADHESIVE ANCHORS

.1 When adhesive anchors are indicated on the drawings, only an acceptable system shall be used. Alternative anchoring systems may be used only when acceptable to Consultant. An acceptable adhesive anchor system may be used as an alternative in locations where epoxy grouted anchor bolts and threaded rod anchors are specified or indicated. The embedment depth for adhesive anchors shall be at least 15 rod diameters unless a greater depth is indicated on the drawings or as required by the product manufacturer.

.2 Adhesive for adhesive anchors shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer's recommendations.

.3 Anchors shall be installed in holes drilled into hardened concrete or grout filled masonry. Diameter of holes shall be 3mm larger than the outside diameter of the rod unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared for insertion of the anchors by removing all dust and debris using procedures recommended by the adhesive manufacturer.

.4 Adhesive anchors and holes shall be clean, dry and free of grease and other foreign matter at the time of installation. The adhesive shall be placed, the rods shall be set and positioned and the adhesive shall be finished, all in accordance with the recommendations of the material manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids and remain filled with adhesive until completion of the curing period. Adhesive shall be cured in accordance with the recommendations of the adhesive manufacturer.

3.6 EXPANSION ANCHORS

.1 When expansion anchors are indicated on the drawings, only an acceptable expansion anchor shall be used. The minimum distance between the centre of any expansion anchor and an edge or exterior corner of concrete shall be at least six times the diameter of the bolt. Unless otherwise indicated on the drawings, the minimum distance between the centres of expansion anchors shall be at least 12 times the diameter of the bolt.

3.7 QUALITY CONTROL

.1 Implement a system of quality control to ensure that the required standards specified herein are attained.

.2 Bring to the attention of the Consultant any defects in the work or departures from the contract documents that may occur during construction. The Consultant will decide upon corrective action and give their recommendations in writing.

.3 The Consultant's general review during construction and inspection and testing by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the WMC of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

3.8 NOTIFICATION

.1 Prior to commencing significant segments of the work, give the Consultant and independent inspection and testing agencies appropriate notification, so as to afford them reasonable opportunity to review the work. Failure to meet this requirement may be cause for the Consultant to classify the work as defective.

3.9 INSPECTION AND TESTING

.1 Appointment of Independent Inspection and Testing Companies:

.1 The WMC will appoint the independent inspection and testing companies to make inspections or perform tests as the Consultant directs. The independent inspection and testing companies shall be responsible only to the Consultant and shall make only such inspections or tests as the Consultant may direct.

.2 When defects are revealed, the WMC may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.

.2 Tests on Installed Anchors:

.1 Anchors: The independent inspection and testing company may test up to ten per cent of some of the installed anchors to the manufacturer’s specified working load. Should defective anchors or under-capacity installations be found, all anchors will be tested, with all associated costs paid for by the Contractor.

3.10 DEFECTIVE MATERIALS AND WORK

.1 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength

made and the like in order to help determine whether the work must be repaired or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense.

.2 All testing shall be conducted in accordance with the requirements of the Ontario Building Code, except where this would in the Consultant's opinion cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.

.3 Materials or work which fails to meet specified requirements may be rejected by the Consultant whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the WMC.

END OF SECTION

DIVISION 6

WOOD, PLASTICS, AND COMPOSITES

SECTION 06100
ROUGH CARPENTRY

SECTION 06100
ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

.1 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes, and Staples.

.2 CSA O121-08 (R2013), Douglas Fir Plywood.

.3 CAN/CSA O141-05 (R2014), Softwood Lumber.

.4 CSA O151-09 (R2014), Canadian Softwood Plywood.

.5 CAN/CSA O325-07 (R2012), Construction Sheathing.

.6 CAN/CSA O80 Series-08 (R2012) Consolidated

.2 Ontario Building Code - Latest Edition

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber.

1.2 QUALITY ASSURANCE

.1 Lumber Identification: By grade stamp of an agency certified by the Canadian Lumber Standards Accreditation Board.

.2 Plywood Identification: By grade mark in accordance with applicable CSA standards.

.3 Plywood, Oriented Strand Board (OSB), and wood-based composite panel construction sheathing identification: By grade mark in accordance with applicable CSA standards.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Store materials in dry locations, leaving 150 mm clearance to the floor.

.2 Protect fire retardant-treated materials against moisture.

1.4 MEASUREMENT AND PAYMENT

.1 All costs associated with the work of this Section shall be included in the price in the Bid Form.

PART 2 PRODUCT

2.1 LUMBER MATERIAL

.1 Softwood Lumber: Unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with the following standards:

.1 CAN/CSA O141-05 (R2014).

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Concealed Framing Lumber:

.1 No. 2 Ontario White Pine, No. 2 Red Pine or Construction No. 1 Eastern Spruce, Balsam Fir or Jack Pine, COFI Douglas Fir Dense, pressure treated.

.3 Wood Blocking Exterior to Air (and Vapor) Barrier:

.1 Construction grade pine, vacuum/pressure impregnated to CAN/CSA O80 Series-08 (R2012) Consolidated.

.4 Pressure Treated Lumber and Pressure Treated Plywood:

.1 CAN/CSA O80 Series-08 (R2012) Consolidated.

.5 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Board sizes: "Standard" or better grade as defined by the NLGA.

.2 Dimension sizes: "Standard" light framing or better grade.

.3 Post and timber sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

.1 Douglas Fir Plywood (DFP): To CSA O121-08 (R2013), standard construction.

.2 Canadian Softwood Plywood (CSP): To CSA O151-09 (R2014), standard construction.

.3 Plywood, OSB, and wood-based composite panels: To CAN/CSA O325-07 (R2012).

2.3 ACCESSORIES

.1 Nails, Spikes and Staples: To CSA B111-1974 (R2003).

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary Fasteners:

.1 Toggle bolts, expansion shields and lag bolts, screws, and lead or inorganic fiber plugs recommended for purpose by manufacturer.

.2 Type 316 stainless steel screws, length 100 percent greater than board thickness minimum, diameter 3 mm minimum, 13 mm dia. Stainless steel washer 1.0 mm thick minimum.

2.4 FINISHES

.1 Galvanizing: use galvanized fasteners for exterior work, interior highly humid areas, pressure preservatives, fire retardant, and treated lumber.

.2 Stainless steel: use stainless steel 304 alloys for chemically corrosive areas and as indicated.

2.5 WOOD PRESERVATIVE

.1 Surface applied wood preservative: clear or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol treated wood must be covered with two coats of a sealer recommended by the manufacturer.

.3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

.4 Submit proof of compatibility between wood preservative used on pressure treated lumber and fasteners to be utilized.

PART 3 EXECUTION

3.1 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as indicated:

.1 Wood cants, fascia backing, curbs, nailers, sleepers on the roof deck.

.2 Wood furring on the outside surface of exterior masonry and concrete walls.

.3 Wood sleepers supporting wood subflooring over concrete slabs in contact with the ground or fill.

3.2 INSTALLATION

.1 Comply with the requirements of the Ontario Building Code, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.3 Align and plumb faces of furring and blocking to a tolerance of 1:600.

.4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.6 Install sleepers as indicated in the Contract Documents.

.7 Use caution when working with particle board. Use dust collectors and high-quality respirator masks.

.8 Select individual pieces without knots and obvious defects that will interfere with placing bolts or proper nailing or making proper connections.

.9 Cut out and discard defects that will render a piece unable to serve its intended function. Lumber may be rejected by the Engineer, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting

3.3 ERECTION

.1 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other items of Work.

3.4 ELECTRICAL EQUIPMENT MOUNTING BOARDS

.1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 mm x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

END OF SECTION

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07100
EXTERIOR WATERPROOFING

SECTION 07100
EXTERIOR WATERPROOFING

PART 1 GENERAL

1.1 SCOPE

.1 This Section refers to the installation of:

.1 The drainage system as indicated on the contract drawings and specified herein and as required to complete the work.

.2 The underslab vapour barrier as indicated on the contract drawings and specified herein and as required to complete the work.

.2 Provide underslab vapour barrier under all floor slabs bearing on soil (unless noted otherwise).

1.2 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 03300 – Cast-In-Place Concrete

.2 Section 07210 – Thermal Insulation

1.3 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American Concrete Institute (ACI:

.1 ACI 302.1R, Guide to Concrete Floor and Slab Construction

.2 American Society for Testing and Materials (ASTM):

.1 ASTM E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

.2 ASTM E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

1.1 SUBMITTALS

.1 Submit manufacturer's product data and application instructions.

.1 Submit all relevant data sheets, showing composition of system, all applicable details, etc.

.2 Confirmation that all components are compatible each other.

1.2 HANDLING, STORAGE AND PROTECTION

.1 All material shall be delivered and stored in their original containers, sealed with labels intact. The manufacturer’s name, brand, weight and specification number, or other reference to accepted standards, shall be clearly shown.

.2 Remove and replace at the Contractor’s expense material that suffered damage, deterioration or contamination of any kind whatsoever, in transit or in storage. Stockpile materials on raised platforms under weatherproof cover.

1.4 PRE-CONSTRUCTION MEETING

.1 Convene one week prior to commencing work of this section meeting with manufacturer’s technical representative, General Contractor and Consultant to review the installation procedures.

1.5 WARRANTY

.1 Warranty period: 5 years from date of substantial completion.

.2 Manufacturer shall furnish material and labour to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.

PART 2 PRODUCTS

2.1 GENERAL

.1 Components and materials must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.

2.2 MATERIALS

.1 Drainage System

.1 Geocomposite drainage system shall consist of a dimpled polymer drainage core with a geotextile filter fabric laminated to one side and

polyester backing film laminated to the other side. System components also include mastic, etc. as recommended by the manufacturer.

.2 Basis-of-design: MEL-DRAIN by W.R. Meadows.

.1 Or approved equal by Henry Company, Soprema or Terrafix.

.3 Provide drainage system over exterior below-grade waterproofing membrane. Tie drainage system into perimeter foundation drain.

.2 Underslab Vapour Barrier

.1 10 mil thick vapour barrier that meets the requirements of ASTM E1745, Class A, B and C. System components include liquid membranes, mastic, termination bar, etc. as recommended by the manufacturer.

.2 Basis-of-Design: PERMINATOR by W.R. Meadows.

.1 Or approved equal.

.3 Provide underslab vapour barrier under all floor slabs bearing on soil and where indicated on the drawings.

.3 Accessories

.1 Provide all accessories needed to complete the work, including mastics, detailing membranes, termination bars, etc.

PART 3 EXECUTION

3.1 GENERAL

.1 Surface preparation and installation of all components are to be in accordance with the manufacturers requirements and recommendations. The requirements described herein are to be considered minimum requirements.

3.2 EXAMINATION

.1 Examine surfaces/substrates to receive membrane and vapour barrier. Notify Consultant if surfaces are not acceptable. Do not begin surface preparation or installation until unacceptable conditions have been corrected.

3.3 PREPARATION OF SURFACES – WATERPROOFING MEMBRANE

.1 Concrete should be cured at least 72 hours, be clean, dry, smooth, and free of voids

.1 Repair spalled areas. Fill all voids and remove all sharp protrusions.

.2 After inspection and any rectification to surfaces, apply primer to Manufacturer's recommendations.

3.4 PREPARATION OF SURFACES – UNDERSLAB VAPOUR BARRIER

.1 Prepare surface in accordance with manufacturers requirements and recommendations. Provide a level surface free from any voids.

.2 Follow ASTM E1643 and ACI 302.1R, Chapter 4.

3.5 INSTALLATION – WATERPROOFING MEMBRANE

.1 Apply waterproofing membrane to primed surfaces in accordance with the Manufacturer's requirements and recommendations.

.1 At all corners, provide membrane detail strips.

.2 Position waterproofing membrane for alignment. Provide 65 mm laps at both sides and ends of waterproofing membrane.

.1 Once positioned, remove protective film and hand-rub membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.

.3 Terminate membrane using termination mastic. Provide termination bars where recommended by the manufacturer.

.4 Seal all penetrations through waterproofing membrane.

.2 Coordinate installation of waterproofing membrane with drainage system.

.3 Install drainage system as per manufacturers written installation instructions. Drainage system is to tie into underslab dewatering system.

3.6 INSTALLATION – UNDERSLAB VAPOUR BARRIER

.1 Apply underslab vapour barrier in accordance with the Manufacturer's requirements and recommendations.

.1 Unroll the underslab waterproofing membrane over the area where the slab is to be poured. Cut to size if necessary. The membrane should completely cover the pour area.

.1 All joints/seams, both side and end, should be overlapped 6" (152.4 mm) and taped. Ensure the taped area is free from dust, dirt, and moisture to allow maximum adhesion of the pressure-sensitive tape.

.2 Seal all penetrations through underslab vapour barrier.

.1 Before placing concrete slab, make sure all penetrations, block outs, and damaged areas are repaired/addressed.

.3 For structural slab, tie underslab vapour barrier in with wall waterproofing membrane.

.4 For nonstructural slab-on-grade, turn vapour barrier up interior vertical face of foundation wall and seal to wall prior to pouring slab.

3.7 PROTECTION

.1 Immediately after the membrane is applied, provide and install protection for the treated surface in accordance with the Manufacturer's recommendations.

3.8 INSPECTION

.1 Conduct a thorough inspection of the systems before covering and make all necessary repairs.

END OF SECTION

SECTION 07210
THERMAL INSULATION

SECTION 07210
THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 06100 – Rough Carpentry

.2 Section 07100 – Waterproofing

.3 Section 07260 – Air and Vapour Barriers

.4 Section 07411 – Preformed Metal Siding & Cladding

.5 Section 07412 – Preformed Metal roofing system

1.2 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C165, Recommended Practice for Measuring Compressive Properties of Thermal Insulations.

.2 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

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

.4 C1104/C1104M, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation

.5 ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.6 ASTM D1621, Test Method for Compressive Properties of Rigid Cellular Plastics.

.7 ASTM E84, Test Method for Surface Burning Characteristics of Building Materials.

.8 ASTM E96, Test Method for Water Vapour Transmission of Materials.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-51.20 Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CGSB 71 GP 24M Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

.3 Underwriters' Laboratories of Canada (ULC):

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

.2 CAN/ULC S114, Standard Method of Test for Determination of Non-Combustibility in Building Materials.

1.3 SUBMITTALS

.1 Product data sheets of all insulation types within the contract and product list indicting where each insulation type will be installed.

.2 Submit 300 mm square sample of each insulation material specified and accessory components.

1.4 DESIGN

.1 Exterior cladding is based on design principle of "Rain Screen" as recommended by the Institute for Research in Construction (National Research Council of Canada). This principle requires that the construction behind cladding act as an air and vapour barrier to prevent passage of moisture-laden air and diffusion of water vapour. To ensure the continuity of air vapour and barrier within construction specified and with adjacent barrier construction is part of the work of this Section.

1.5 QUALITY ASSURANCE

.1 Applicator qualifications: Applicator shall have not less than five years, continuous proven experience installing insulation.

.2 Employ only skilled workers having experience and an understanding of design principles of thermal, air and vapour barriers.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Materials shall be delivered in manufacturer's original containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.

.2 Material shall be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer.

.3 Empty containers shall be removed from site on a daily basis.

.4 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 SITE CONDITIONS

.1 Maintain 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.

.2 Ventilate insulation application area in accordance with the Spray Foam Coalition's Guidance on best practices for the installation of Spray Polyurethane Foam.

.3 Protect workers as recommended by the Spray Foam Coalition's Guidance on bet practices for the installation of Spray Polyurethane Foam.

.4 Protect adjacent surfaces, windows, equipment and site areas from damage of overspray.

1.8 WARRANTY

.1 Submit a two-year warranty for the Work of this Section against defects in materials and workmanship including but not limited to integrity and continuity of the thermal, air and vapour barriers.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Wall and Roof Insulation: Heatlok Spray Form insulation or approved equal.

.1 Properties:

.1 Fire performance:

.1 Smoke development: ASTM E84 350-400.

.2 Flame spread index: ASTM E84 12.

.3 Surface burning characteristics: ASTM E84 Class 1

.2 Thermal resistance ASTM C518: 25.4mm = 1.3 RSI, 88.9mm = 4.04 RSI. thickness (1" = R-7.4, 3.5" = R-23).

.3 Air Permeance: ASTM E283 at 75pa at 1" <0.02L/s.m2

ASTM E2178 at 75pa at 1" <0.02L/s. m2

.4 Water vapour permeance: ASTM E96 at 1" Class 2 vapour retarder 0.91 perms 52 .5 ng/Pa.s.m2.

.5 Water Absorption: ASTM D2824 0.3%.

.6 Fungi resistance: ASTM C1338 Zero mould growth

.7 Density: ASTM D1622 2.0-2.4lb/ft3 32-38.4kg/m3

.8 Dimensional Stability: ASTM D2126 (% of change in volume at 28 days) 158°F (70°C) 97% R.H. -3.7%.

.9 Ignition Properties: ASTM D1929 766°F 408°C

.10 Compressive Strength: ASTM D1621 31psi 214kpa

.11 Tensile Strength: ASTM D1623 44psi 303kpa

.12 Closed Cell Content: ASTM D2856 98%

.2 Accessories:

.1 Water Based Intumescing coatings:

.1 Product: DC315, Manufactured by International Fireproof Technology, Inc.

.2 Product: No-Burn Plus Thb, Manufactured by No-Burn, Inc.

.2 Primers:

.1 Product: Adbond manufactured by Adfast or Thermo-Prime by Huntsman Building Solutions

.2 Below grade insulation: Foamular® 400 High Density extruded polystyrene insulation, manufactured by Owens Corning, or approved equal.

.1 Minimum compressive strength: 275 kPa (40 p.s.i.).

.2 Water Absorption (% by volume): 0.60 max.

.3 Thermal resistance: RSI 0.87/25 mm (R5/inch).

.4 Total thickness: As per Contract Drawings.

.3 Adhesive:

.1 Adhesive for polystyrene: type compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify General Contractor, Architect or other point of contact of unsatisfactory preparation before proceeding.

.3 Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

3.2 PREPARATION

.1 Clean urfaces thoroughly prior to installation.

.2 Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.

.3 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

.4 It is recommended to install primer on oily surfaces and galvanized steel

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Apply as recommended by manufacturer to thickness as indicated on drawings.

.3 Equipment used to apply the foam insulation shall have fixed ratio positive displacement pumps approved by foam manufacturer.

.4 Installation – Below Grade Perimeter Insulation

.5 Install below grade perimeter insulation to exterior foundation walls as shown on the drawings.

.6 Laminate insulation to vertical walls by applying 50 mm dia. adhesive daubs at 600 mm o.c in every direction.

.7 Insulation Boards to be tightly butted together.

3.4 CLEANING

.1 Clean surfaces marred or otherwise damaged to Owners Representatives acceptance, including steam cleaning. Pay the cost of replacing finishes or materials that cannot be cleaned.

3.5 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07260
AIR AND VAPOUR BARRIERS

SECTION 07260
AIR AND VAPOUR BARRIERS

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 07210 – Thermal Insulation

.2 Section 07412 – Preformed Metal Roof System

.3 Section 07465 – Preformed Metal Cladding

.4 Section 07620 – Sheet Metal Flashing and Trim

.5 Section 08110 – Doors and Frames

.6 Section 08520 – Aluminum Windows

1.2 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American Society for Testing and Materials (ASTM):

.1 ASTM E96, Standard Test Methods For Water Vapor Transmission Of Materials

.2 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

.3 ASTM E283, Standard Test Method For Determining Rate Of Air Leakage Through Exterior Windows, Curtain Walls, And Doors Under Specified Pressure Differences Across The Specimen

.2 Canadian General Standards Board (CGSB):

.1 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing

.2 CGSB 71-GP-24M, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all air/vapour barrier membrane and accessory materials to the site in original and unopened packaging with the manufacturer's labels intact.

.2 Protect materials stored on site from precipitation, ground moisture, temperature extremes and mechanical damage.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01330 – Submittal Procedures.

.2 Submit product data sheets of all components to be used.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

.2 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Vapour Barrier Membrane: Vapour Barrier Membrane shall be a SBS modified bitumen, self-adhering type, complete with cross laminated polyethylene film on the upper surface and a release film on the lower surface.

.1 Product: Blueskin SA manufactured by Henry Company.

.1 Or approved equal.

.2 Vapour barrier membrane is to have the following physical properties:

.1 Thickness: 1 mm (40 mils) min.

.2 Air leakage: <0.01 L/s.m² at 75 Pa to ASTM E283-91.

.3 Vapour permeance: 1.6 ng/Pa.m².s (0.03 perms) to ASTM E96.

.4 Low temperature flexibility: 30 degrees C to CGSB 37-GP-56M.

.5 Elongation: 200% to ASTM D412-modifed.

.6 Water vapour permeance: 1.7 ng/Pa.m².s. (0.03 perms).

.7 Long term flexibility: CGSB 71-GP-24M.

.8 Chemical resistance: Alkalis and salt.

.2 Thru-wall Flashing: Thru-wall flashing membrane and dampproof course shall be a SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film

.1 Product: Blueskin® TWF manufactured by Henry Company.

.1 Or approved equal.

.2 Flashing membrane is to be compatible with the vapour barrier membrane.

.3 Flashing membrane is to be manufactured by the same manufacturer as the vapour barrier membrane.

.4 Flashing membrane is to have the following physical properties:

.1 Colour: Yellow.

.2 High Temperature Stability: 110 deg C min. to ASTM D5147 (resistance to flow).

.3 Thickness: 1.0 mm (40 mils) min.

.4 Air leakage: <0.005 L/s.m² at 75 Pa to ASTM E283-91.

.5 Water vapour permeance: 1.6 ng/Pa.m².s (0.03 perms) to ASTM E96.

.6 Low temperature flexibility: -30 degrees C to CGSB 37-GP-56M.

.3 Primer: Primer for self-adhering membranes at all temperatures shall be as recommended by the membrane manufacturer.

.4 Sealant/Mastic: Sealant and mastic to be as recommended by the membrane manufacturer.

.5 Roof Vapour Barrier: 6 mil poly vapour barrier.

PART 3 EXECUTION

3.1 INSPECTION OF SURFACES

.1 Examine surfaces to which membrane is to be applied to ensure that they are smooth, clean, dry and free of surface irregularities, voids, coatings or other conditions which would adversely affect the installation of the membrane.

.2 Do not proceed with application of the air/vapour barrier membrane until all unsatisfactory conditions have been corrected.

3.2 PREPARATION OF SURFACES

.1 Clean surfaces as required. Surfaces are to be clean of oil, dust, and excess mortar.

.2 Make smooth substrate surface. Surface is to be free from large voids, spalled areas and sharp protrusions.

.3 Apply primer to all surfaces receiving self-adhered membrane in accordance with the manufacturer’s written instructions.

3.3 INSTALLATION - VAPOUR BARRIER MEMBRANE AND FLASHING MEMBRANES

.1 Apply self-adhering vapor barrier membrane complete and continuous to prepared and primed substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.

.1 Prime surfaces as per manufacturers’ instructions and allow drying.

.2 Align and position self-adhering vapor barrier membrane, remove protective film and press firmly into place. Ensure minimum 50mm overlap at all end and side laps of membrane.

.3 Roll all laps and membrane with a counter top roller to ensure seal.

.4 Where recommended by the manufacturer seal penetrations, etc. with a continuous bead of compatible sealant.

.5 At the end of each day’s work seal the top edge of the membrane where it meets the substrate with termination sealant. Trowel applies a feathered edge to seal termination and shed water.

.2 Flashing Membranes:

.1 Shiplap vapour barrier membrane over thru-wall flashing wherever possible.

.2 Keep thru-wall flashing 12-25mm from outside face of wall or veneer.

.3 At all laps, seams, penetrations, and along to edges of membrane apply a continuous bead of compatible sealant.

.3 All penetrations through vapour barrier shall be sealed to ensure a continuous vapour barrier envelope.

.1 At wall to roof transition, ensure a continuous vapour barrier envelope.

END OF SECTION

SECTION 07411
METAL SIDING & CLADDING

SECTION 07411
METAL SIDING & CLADDING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of the Contract and all Sections of Divisions 00 and 01, shall form an integral part of the requirements of this Section.

.2 All addenda or corrections issued during the time of the bidding process shall also become part of the contract documents, and shall be covered in the Trade Contractor's bid.

.3 Cooperate and coordinate with the requirements of other Trade Contractors specified in other Sections.

1.2 SECTION INCLUDES

.1 Prefinished Steel Siding.

.2 Z-bar furring.

.3 Fasteners and closures.

1.3 REFERENCES

.1 All Standards listed below are to be the most current edition at the time of tender regardless of any older dates that may be listed herein unless specifically noted otherwise. Withdrawn or obsolete standards may still apply unless it has been replaced with a different Standard in which case the new Standard shall apply. Report any withdrawn Standards to the Consultant for instructions.

.2 ULC 101: Standard Methods of Fire Endurance Tests of Building Construction and Materials (CAN/ULC S101-14)

.3 ULC 102 -18: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies (CAN/ULC S102).

.4 ULC 114 -18: Standard Method of Test for Determination of Non-Combustibility in Building Materials (CAN/ULC S114)

.5 ULC 134: Standard Method of Fire Test of Exterior Wall Assemblies (CAN/ULC S134-13)

.6 ULC S135 -16: Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter), Includes Amendment 1

.7 CSA S136 -12 Package: North American Specification for the Design of Cold Formed Steel Structural Members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members

.8 CSSBI 20M -17: Standard for Sheet Steel Cladding for Architectural, Industrial and Commercial Building Applications.

.9 CSSBI S14 -00: CSSBI How to Series - Lightgauge Steel Roofing and Siding.

.10 CSSBI S8 -08: Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

.11 ASTM A385/A385M -17: Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

.12 ASTM A606/A606M -18: Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

.13 ASTM A653/A653M -18: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.14 ASTM A755/A755M -18: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

.15 ASTM A792/A792M-10(2015): Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.16 ASTM A924/A924M-18: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.17 ASTM B209 -14: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.18 ASTM B209M -14: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

.19 ASTM D2244 -16: Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

.20 ASTM D4214 -07(2015): Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

.21 Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA) "Architectural Sheet Metal Manual", latest edition.

.22 If requested by the Consultant provide a PDF digital copy of any or all of the Standards above as selected by the Consultant at no additional cost.

1.4 QUALIFICATIONS

.1 .1 Perform all work of this Section using manufacturer's approved installer, employing skilled tradesman only in strict accordance with manufacturer's printed specifications.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1.

.2 Clearly show arrangement of sheets and joints, mitred corners, assembly and installation details and methods, types and location of all fastenings, thickness and size of material, spacing of "Z" girts, furring channels, framing, and special shapes. Verify all dimensions with job conditions before fabricating.

.3 Indicate locations of fasteners, sizes and types, including repetitive pattern of installation.

.4 Show details of all closures where applicable.

.5 Show isometric views of mitred corners, joining and fastening of sheet metal at all conditions where surfaces intersect of change plane.

.6 Shop drawings are to show all loading calculations for the area of install.

.7 Shop drawings are to be signed and sealed by a professional Engineer licenced to practice in Ontario. All engineering costs are to be included in the Bid.

1.6 SUBMITTALS

.1 Submit samples in accordance with Division 1.

.2 Submit duplicate 600 x 600 mm samples of each type of sheet metal and each colour and each type of fastener required for the Work.

.3 Submit duplicate mitred corner samples showing joint, sealant and connectors to the Consultant for review and approval.

.4 Submit proof of origin/mill including MSDS sheets showing galvanizing meets specification below. Only metal from specified manufacturer’s will be accepted unless pre-approved at time of Tender.

.5 Submit waybills, copies or purchase orders or receipts to the Consultant as evidence that the metals used on this project are from the approved manufacturers. **Imported metals from overseas will not be accepted on this project.**

1.7 WARRANTY

.1 Furnish a minimum manufacturer's standard 20 year warranty stating architectural finish will be:

.1 Free from fading or colour change in excess of 5 NBS units as measured per ASTM D2244;

.2 Will not chalk in excess of numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D4214;

.3 Will not peel, crack, chip, or delaminate.

.4 Correct defective material within a twenty (20) year period after Substantial Performance for degradation of panel finish including colour fading caused by exposure to weather. Warranty shall include labour costs and material.

.2 Provide an installers five (5) year warranty covering workmanship. Correct defective Work within a five (5) year period after Substantial Performance.

1.8 PROTECTION

.1 Protect work of other trades from damage resulting from work of this Section. Make good all damage to work of other trades resulting from work of this Section.

.2 Protect insulation from getting wet prior to, during and after installation. Replace all insulation that has become wet.

.3 Product Handling and Storage

.4 Deliver metal cladding to the job site as required for erection. If delivered early, store inside the building if possible.

.5 If outside storage is necessary, stack bundles clear of the ground and tilted slightly to ensure that no water is allowed to lie. Take precautions to avoid storage stain or damage to the surface finish of the material.

1.9 SURFACE EXAMINATION

.1 Before installation of this Section, inspect and take field measurements of all surfaces to receive metal cladding and of the work done by other trades which may affect the work of this Section.

.2 Ensure the air/vapour barrier is installed in accordance with Section 07260 and insulation has been installed in accordance with Section 07210 and that it has been reviewed by the Consultant prior to proceeding with the Work of this Section.

.3 Inspect surfaces to receive metal cladding and verify that they are sound, well fastened, and smooth. Look for metal fasteners that are not well set into the surface, or that appear to be in danger of working loose or "popping". Look for situations where cladding would be in contact with other metals, particularly aluminum and between galvanized surfaces. Advise the Consultant of any problems and do not proceed until they have been resolved.

.4 Notify the Consultant of surfaces which are considered unacceptable to receive the work of this Section. Commencement of work will imply unconditional acceptance of the surfaces and of the work done under other Sections or by other contractors.

.5 In case of any discrepancies, the necessary adjustments will be arranged in such time that no delay in the work results.

.6 Check surfaces to which metal cladding and trim are to be applied and report any defects to the consultant.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Metal Cladding: conforming to CAN/ULC S114 & ULC 134; Prepainted, hot dipped galvanized Z275 designation cold formed steel conforming to ASTM A653/A653M (current edition). Galvanize in accordance with ASTM A924/A924M (current edition), factory precoated with Silicone Modified Polyester (SMP); Vicwest 'Weatherx" or equal; colour to be as indicated on the Drawings on exposed surface. For additional protection a wash coat of 0.3 - 0.4 mil dry film thickness is applied to the reverse side; 0.61 mm base metal thickness. Profiles to be as indicated on the Drawings or equivalent by one of the following approved manufacturers.

.1 Firestone

.2 Vicwest

.3 or preapproved product. Alternative manufacturers of this Section must be approved at time of tender.

.2 Exterior Sheet (flat sheet): conforming to CAN/ULC S114 & ULC 134; Prepainted, hot dipped galvanized Z275 designation cold formed steel conforming to ASTM A653/A653M (current edition). Galvanize in accordance with ASTM A924/A924M (current edition), factory precoated with Silicone Modified Polyester (SMP); Vicwest ‘Weatherx” or equal; colours to be as indicated on the Exterior Finishes Schedule on exposed surface. For additional protection a wash coat of 0.3 – 0.4 mil dry film thickness is applied to the reverse side. 0.61 mm

base metal thickness. Provide stiffeners as required to eliminate oil canning. One of the approved manufacturers.

.1 Firestone

.2 Vicwest

.3 or preapproved product. Alternative manufacturers of this Section must be approved at time of tender.

.3 Z-bar furring: manufacturer's standard Z-bars, minimum 1.2 mm base metal thickness or as otherwise required to withstand all superimposed loading, widths as indicated, Z275 hot-dipped galvanized .

.4 Furring Channels: hat-shaped, from minimum 1.2 mm base metal thickness or as otherwise required to withstand all superimposed loading, Z275 hot-dipped galvanized sheet steel 22 mm deep x 32 mm wide face.

.5 Transition Reveals: metal reveals between metal cladding and fibre cement cladding. Types as indicated on the Drawings and reviewed shop drawings. Colours and finish as selected by the Consultant.

.6 Fasteners: Use manufacturer's recommended fasteners to meet the load requirements. All fasteners to be concealed. Galvanized or stainless steel.

.7 Board Insulation: as specified in Section 07210.

.8 Sealants: Sealant Type 1 as specified in Section 07900.

PART 3 EXECUTION

3.1 INSTALLATION/GENERAL

.1 Install preformed metal soffits, siding, cladding and trim to locations in accordance with manufacturer's recommendations.

.2 Fabrication of components on site is not acceptable.

.3 Before installation, check wall alignment.

.4 Exercise care when cutting siding, cladding and trim materials on site, to ensure cuttings do not remain on finish surface.

.5 Protect soffits, siding, cladding and trim surfaces in contact with other dissimilar metals, including galvanized and aluminum surfaces, with bituminous paint. Allow protective coating to dry prior to installing members.

.6 Completed installation is to be free of rattles and wind generated noise.

3.2 INSTALLATION/SIDING & CLADDING

.1 At locations where siding and cladding is installed over wood studs and sheathing, concrete and other backing as indicated, and air/vapour barrier membrane or exterior sheathing membrane, install Z bar furring at 400 mm oc, (or as otherwise indicated on the approved shop drawings) to vertically where siding is installed horizontally, and horizontally where siding is installed vertically and fasten through air/vapour barrier or exterior sheathing membrane and gypsum sheathing and into steel studs at all locations where Z bars cross studs . Ensure Z bar ends occur over firm bearing. At concrete backing, fasten into concrete backup at 400 mm oc maximum, and 75 mm from ends. Fasten Z girts to withstand all superimposed loading. Coordinate with installation of air/vapour barrier membrane. Where Z bars are installed vertically over gypsum board and steel stud backup, ensure Z bars are installed at spacings to match metal studs, and are fastened through into metal studs at 400 mm oc.

.2 Permanently fasten metal siding and cladding to furring channels, properly aligned, and true to line. Maximum offset from true alignment between adjacent members in line, to be maximum variation in plane to be 3.2 mm.

.3 Install flat sheet siding and cladding to locations indicated. Install complete with stiffeners to eliminate oil canning.

.4 Install siding and cladding vertically and horizontally, using as long pieces as possible with as few joints as possible.

.5 Locate ends over firm bearing. Avoid end lapping panels. Where end laps cannot be avoided, overlap ends minimum 100 mm.

.6 Provide expansion joints as required.

.7 Install all necessary closures and trim as indicated on the drawings to the satisfaction of the Consultant. Install reveals and transition trim pieces as indicated on the Drawings and reviewed shop drawings.

.8 Adjust siding and cladding and trim to final position before permanently fastening to substrate and supports.

.9 Use concealed fasteners to all locations.

3.3 CLEAN-UP

.1 Leave all panels clean and free from all grime and dirt; remove and dispose of all debris, waste materials, crating and equipment. Leave job in clean condition.

END OF SECTION

SECTION 07412
PREFORMED METAL ROOF SYSTEM

SECTION 07412
PREFORMED METAL ROOFING SYSTEM

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions.

1.2 DESCRIPTION

.1 General Requirements

.2 Division 1, General Requirements, is part of this specification and shall apply as if repeated here.

1.3 WORK FURNISHED AND INCLUDED:

.1 Underlayment

.2 Roof panel clip system.

.3 Roof panel.

.4 Accessories including associated flashings, closures, sealants.

1.4 RELATED WORK NOT INCLUDED:

.1 Solid substrate support for Metal Roofing System.

.2 Mechanical equipment and/or ductwork as well as their supporting framing.

.3 Flashings associated with other trades.

1.5 REFERENCES

.1 ASTM-A446M Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

.2 ASTM-A525M General Requirements for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process.

.3 ASTM-792M Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot-Dip Process, General Requirements [Metric].

.4 CAN/CGSB-1.108-M Bituminous Solvent Type Paint.

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

.6 CAN/CGSB-51.20-M Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.7 CAN/CSA-A82.27-M Gypsum Board Products.

.8 CSA A101-M Thermal Insulation, Mineral Fibre, for Buildings.

.9 CAN/CSA S16.1-M Limit States Design of Steel Structures.

.10 CAN/CSA-O80 Series-M Wood Preservation.

1.6 DESIGN REQUIREMENTS

.1 Design metal roofing panels, anchors, fastenings and secondary support system to withstand applicable loads established by the OBC and applicable local regulations for the locality. Deflection of profile sheets: Maximum 1/180th of span at this loading. Reference velocity pressure: Based on hourly wind pressures of one in 30.

.2 Design metal roofing system to comply with CAN/CSA S16.1.

.3 Design metal roofing system to allow for thermal movement of components caused by ambient temperature range without causing deterioration of system.

.4 Design metal roofing system using concealed fastening details.

.5 Design components to resist vibration when subjected to the effects of wind.

.6 Attic Ventilation

.1 Provide a balanced ventilation system with a minimum amount of 1m^2 of net free ventilating area for every 150m^2 of attic space measured at the attic floor level (1:150 ventilation ratio) as recommended by the National Roofing Contractors Association (NRCA).

.2 50% of the attic ventilation is to be at the roof low point; perforated soffit vents. The remaining attic ventilation is to be located at or near the roof ridge in the form or ridge vents and turbine ventilators.

1.7 SUBMITTALS

.1 Shop drawings:

.1 Submit shop drawings indicating material being supplied, thickness, metal finishing specifications, layout of panels and battens, special shapes and girts, connections, attachments, anchorage and location of fastenings, flashings and closure flashings and sealing.

.2 Indicate design loads and spans, sheet lengths and lap locations.

.3 Indicate provision for structural and thermal movement between metal roofing and adjacent materials.

.4 Submit shop drawings signed and sealed by professional engineer licensed in the Province of Ontario.

.2 Submit all available colour samples from manufacturer's colour chart (10,000 series) for final selection. Samples shall be 150mm x 150mm minimum.

.3 Submit metal finishers certificate that coating system provided meets the specifications.

.4 Submit manufacturer's instructions for installation of materials and manufactured units as required.

1.8 QUALITY ASSURANCE

.1 Qualifications: Perform the work of this Section by a company in good standing of the Canadian Sheet Steel Building Institute and the Canadian Institute of Steel Construction.

.2 Minimum five years proven acceptable experience installing metal roofing on projects of comparable size and scope.

.3 Prior to commencement of metal roofing construction, submit list of project names, owners, contacts, dates completed and construction costs.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Package materials to protect finished surfaces from staining and marring.

.2 Store roofing panels flat at site under protection to prevent staining from the ground or from collection of water on material and secured against wind damage.

.3 Deliver materials to job site storage compound in such a manner to prevent in-transit damage. These measures include, but are not limited to crating, polyethylene wrapping system, and similar items.

1.10 GUARANTEE

.1 For work in this section, warranty by installer against defects or deficiencies in materials or workmanship shall be for a period of two years from date of substantial completion.

1.11 WARRANTY

.1 Provide a manufacturer's written warranty: Furnish panel manufacturer's written warranty covering failure of factory-applied exterior finish within the warranty period. Warranty period for finish: 35 years after the date of Substantial

Completion. The values below are based on normal environments and exclude any aggressive atmospheric conditions.

.1 10,000 Series (Polyvinylidene Flouride - PVDF) will not visibly (within 10 metres to the unaided naked eye) crack, chip, or peel (lose adhesion) for thirty-five (35) years from date of application. This does not include minute fracturing that may occur during the normal fabrication process. 10000 Series (Polyvinylidene Flouride - PVDF) will not chalk in excess of a number eight (8) rating, in accordance with ASTM D-4214-98 method D659 at any time for thirty-five (35) years from date of installation (35.5 yrs from application); will not change colour more than five (5.0) Hunter ΔE units as determined by ASTM method D-2244-02.

PART 2 PRODUCTS

2.1 ROOF SYSTEM MANUFACTURER

.1 Preferred metal roofing system: Marquis System 450, by VicWest Steel Inc.

.2 Alternate metal roofing system: Batton Clad Metal Roofing System by Roll Form Group or approved equal.

2.2 ROOF SYSTEM COMPONENTS

.1 Underlayment: Membrane shall be ROOF RF 200 by Blueskin, or approved equal.

.2 Roof Board: Roof board shall be Densdeck DuraGuard by Georgia-Pacific, or approved equal.

.3 Clip System:

.1 Thermally responsive flush mount clip system, designed to allow for full thermal expansion and contraction of the exterior roof sheet. Clips to be fabricated from a minimum of 1.22 mm (.048") steel, with minimum Z275 galvanized coating.

.2 Roof Fasteners: As specified by manufacturer, to resist wind uplift and sliding snow forces.

.4 Steel sheet: Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 or AZ150 Galvalume, sheet steel conforming to ASTM A792M Grade 230, having a nominal core thickness 0.76mm.

.5 Closures, flashings, coping flashings, trim: Same material and finish used for roofing panels and battens, 0.61 mm nominal core thickness.

.1 Expansion joint: Expand-o-flash by John Manville or approved equal. Waterproofing underlayment to be installed continuously under the flashing and over each flange. Install as per manufacturers written installation instructions.

.2 Roof penetrations: Provide flashings for all roof penetrations. Flashings to be by Thaler Metal Industries Ltd. Flashing type to suit penetration type.

.6 Closure (ends): Metal closure to suit profile selected, to manufacturer's recommendations.

.7 Sealants: In accordance with manufacturer's recommendation

.8 Eavestrough and downspout: Same material, 0.76 mm thickness and finish used for roofing panels and battens. Fabricate to profiles indicated. Fabricate prefinished support straps.

.1 Form and install scuppers and rain water leaders and downspouts. Seal joints of gutters watertight.

.2 Provide strainer baskets at outlets and fastenings as required.

.3 Provide precast concrete splash pad at each downspout.

.9 Soffit: Same material, 0.76 mm thickness, and finish used for roofing panels and battens. Fabricate perforated vented panels as required to adequately ventilate the attic space.

.10 Snow fence: Stainless steel plates, strips and rods in manufacturer's standard configuration.

.11 Snow fence subgirt: Galvanized steel minimum 1.89 mm thick to support snow fence bracket.

.12 Ice deflector: Same material, thickness and finish used for roofing panels and battens.

.13 Turbine vents: 350mm internally braced aluminum turbine vents as recommended by roof manufacturer. Provide quantity of ventilators required to adequately ventilate the attic space.

.14 Precast concrete splash pad: Splash Pad by Brooklin Concrete Products Ltd. 55 Mpa concrete compressive strength at 28 days.

.15 Plywood: CSA O121-M, 20 mm thick Douglas fir plywood, preservative treated to CAN/CSA-O80.

2.3 PANEL FINISHES

.1 Metal coating system: Coil-coated, baked-on, 70% Kynar 500 polyvinylidene fluoride, dry film thickness of 22.5 micron ±5 micron 10,000 Series by Stelco Inc. or Dofasco Inc. on exposed surfaces. Pretreat and prime surfaces prior to application of coating. Prime and wash coat finish unexposed surfaces.

.2 Colour: Dark green. Contractor to submit all available colour samples from manufacturer's colour chart (10,000 series) for final selection.

2.4 FABRICATION

.1 Start fabrication of roofing panels from accepted shop drawings and site measurements.

.2 Take site measurements to ensure fabrications fit structure, surrounding construction, around obstructions and projections in place and to suit locations of services.

.3 Form roofing panels to profiles indicated and in accordance with manufacturer's directions without face damage or distortion.

.4 Fabricate panels one piece full length.

.5 Fabricate securement members required for anchorage and attachment of panels to structural framing members for support of roofing system.

.6 Fabricate trim and closures at openings to match panel finish.

.7 Fabricate eavestrough and downspout profiles to manufacturer's shop drawing details.

.8 Fabricate soffit panel profiles to manufacturer's shop drawing details. Fabricate vented panels as required.

.9 Fabricate snow fences and ice deflectors to manufacturer's shop drawing details.

.10 Finish exposed surfaces of metal with Metal Coating System.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Ensure that backup construction is aligned for proper installation of preformed metal roofing before commencing erection.

.2 Examine surfaces of structural roof deck and report conditions which would adversely affect metal roofing.

.3 Commence work after unsatisfactory conditions are corrected. Commencement of work implies acceptance of project conditions.

3.2 PREPARATION

.1 Install and clean wood roof joists and plywood sheathing board before application of roofing system. Close ends of roof deck flutes.

3.3 INSTALLATION

.1 Roof Materials:

.1 Roof board: Install roof board as per manufacturers writing instructions. Number of fasteners per board is stipulated by manufacturer.

.2 Underlayment: Install underlayment fully adhered to roof board according to manufacturer's recommendations. Ensure all joints are properly lapped and sealed. Tie in with barriers on adjacent surfaces to ensure airtight construction. Provide a continuous seal around all openings.

.3 Clip System: Attach Marquis clips using fasteners as recommended by the manufacturer, to suit the substrate.

.2 Roof Panel Installation

.1 Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure. Ensure metal roofing sheet side-lap is positively retained by clips, and proper sheet coverage is maintained.

.2 Raw metal edges exposed of metal panels terminating at eaves and valleys are acceptable. Secure panels with face fasteners.

.3 Where indicated on approved shop drawings, secure the end-lap of metal roofing sheets in accordance with the manufacturers specifications and details to provide a weather-tight seal. Exposed fasteners to match colour of the roof sheet.

.4 Provide notched and formed closures, sealed against weather penetration, at changes in pitch, and at ridges and eaves, where required, to maintain wind and rain tightness.

.5 Install all companion flashing, gutters, ventilators as shown on the shop drawings. Use concealed fasteners when possible. Exposed fasteners to match colour of roof sheet.

.1 Form and install coping flashings contiguous with preformed metal roofing. Install continuous metal drips, cleats, clips and starter strips.

.2 Provide ridge, hip, valley, and vertical wall flashings. Use preformed flashings for vents and similar protrusions.

.3 Provide and install flashings for all roof penetrations and expansion joints.

.3 Miscellaneous component installation

.1 Provide girt centred under ice fence. Provide ice fence using aluminum angle secured through roofing into girt at 600 mm o.c. max. Locate ice fence 300 mm from bottom edge of roofing.

.2 Install flashings with S locks for concealed fastening.

.3 Install continuously vented ridge with concealed fastening. No raw edges permitted.

.4 Lap flashing ends and install with face fasteners.

.5 Install snow fences along eaves spaced maximum 900 mm from eave. Fasten snow fence baseplates back down to snow fence subgirt in accordance with manufacturer's recommendations. Isolate snow fence baseplates from metal roofing with neoprene pads.

.6 Secure ice deflectors at eaves below line of snow fences. Install in three raws staggered along entire roof perimeter.

.7 Install trim required for soffit panels. Install soffit panels in direction perpendicular to wall with concealed fastening.

.8 Install eavestroughs and downspouts as indicated. Secure with support straps at 2500 mm o.c. maximum. Install splashpad centred on downspout outlet on crushed gravel sloping away from building. Seal eavestrough watertight.

.9 Touch up minor paint abrasions with air dry touch up paint of formulation to match factory finish.

.4 Sealant Installation

.1 Seal joints between metal roofing panels, and between roofing panels and adjacent surfaces.

.2 Seal roofing system air and watertight.

.3 Before application of sealant, clean and dry joint surfaces. Apply primer and sealant in accordance with manufacturer's printed instructions. Tool sealant to concave profile.

.5 Cleaning

.1 Clean exposed panel surfaces in accordance with manufacturer's instructions.

.6 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable by sealant manufacturer and metal fabricator.

.7 Where accumulation of dirt does not respond to cleaning required, refer condition to Engineer, with recommendations as to remedial action required; do not undertake any cleaning procedure of a severe nature without written acceptance.

3.4 FINAL INSPECTION

.1 At completion of roofing installation meet with installer, installers of associated work, Owner, and other representatives directly concerned with performance of roofing system.

.1 Inspect roof surface areas, perimeter building edges, flashings of roof penetrations, and flashings of walls, curbs and other equipment.

.2 List all items requiring correction or completion and furnish copy to each party attending.

.3 Repair or replace deteriorated or defective work in accordance with warranty requirements.

.2 Following final inspection and corrections, material manufacturer to issue written acceptance and certification of installation.

END OF SECTION

SECTION 07620
SHEET METAL FLASHING AND TRIM

SECTION 07620
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 07465 – Preformed Metal Cladding

.2 Section 07412 – Preformed Metal Roof System

.3 Section 07900 – Joint Sealants

1.2 REFERENCE STANDARDS

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American Society for Testing and Materials (ASTM):

.1 A153/A153M, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

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

.3 B32, Standard Specification for Solder Metal.

.4 D1187/D1187M, Standard Specification for Asphalt Base Emulsions for Use as Protective Coatings for Metal.

.2 Canadian Standards Association (CSA International):

.1 CAN/CSA A371, Masonry Construction for Buildings.

.3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

.1 Architectural Sheet Metal Manual.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Show profiles, joints, types and location of fasteners, special shapes, etc.

.2 Catalog data for stock manufactured items.

.2 Samples:

.1 Submit hard-copy colour brochure for initial colour selection.

.2 Following initial colour selection, submit duplicate 200 x 200 mm samples of each type of sheet metal material, colour and finish.

1.4 QUALITY ASSURANCE

.1 Installer:

.1 Membership in good standing of Canadian Roofing Contractors Association.

.2 Minimum five years proven satisfactory experience installing sheet metal work on projects of comparable scope.

1.5 DELIVERY, HANDLING, AND STORAGE

.1 Package and protect during shipment.

.2 Inspect for damage, dampness, and wet storage stains upon delivery to Work site.

.3 Remove and replace damaged or permanently stained materials that cannot be restored to like-new condition.

.4 Carefully handle to avoid damage to surfaces, edges, and ends.

.5 Do not open packages until ready for use.

.6 Store materials in dry, weathertight, ventilated areas until immediately before installation.

.7 Prevent contact of dissimilar metals during storage and protect from acids, flux and other corrosive materials and elements.

1.6 WARRANTY

.1 Provide the following warranties:

.1 Manufacturer’s standard twenty (20) year finish warranty covering checking, crazing, peeling, chalking, fading, or adhesion.

.2 Installers two (2) year warranty covering flashing installation, including weathertightness of system.

.3 Warranties shall commence on date of Substantial Completion.

.4 Warranty shall provide for correction and/or removal and replacement of systems or components found to be defective during the warranty period.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Galvanized Sheet Steel: ASTM A653/A653, 0.61 mm nominal core thickness (24 gauge), unless otherwise shown with full strength fluoropolymer coating (Kynar polyvinylidene fluoride resin), colour to be selected from manufacturer's color chart.

2.2 REGLETS AND COUNTERFLASHING

.1 Provide reglets and counterflashing where shown on drawings and where required.

.2 Approved manufacturers:

.1 Fry Reglet Corporation (Basis-of-design)

.2 Cheney Flashing Company

.3 W.P. Hickman Company

.3 For Concrete:

.1 Galvanized sheet steel with full strength fluoropolymer coating.

.2 Fry Springlok Type CO and Springlok Flashing by Fry Reglet Corporation.

.1 Or approved equal.

.4 Surface Mounted:

.1 Galvanized sheet steel with full strength fluoropolymer coating.

.2 Fry Reglet Corp.; Fry Springlok Type SM and Springlok Flashing by Fry Reglet Corporation.

.1 Or approved equal.

2.3 SCUPPERS, CONDUCTOR HEADS AND DOWNSPOUTS

.1 Scuppers:

.1 Galvanized sheet steel with full strength fluoropolymer coating.

.2 Fully welded thru-wall scupper sleeve by Hickman Edge Systems.

.1 Or approved equal.

.2 Conductor Heads:

.1 Galvanized sheet steel with full strength fluoropolymer coating.

.2 Fully welded conductor heads by Hickman Edge Systems.

.1 Or approved equal.

.3 Downspouts:

.4 Galvanized sheet steel with full strength fluoropolymer coating.

.5 Box downspout by Hickman Edge Systems.

.1 Or approved equal.

2.4 MISCELLANEOUS FLASHINGS

.1 Miscellaneous flashings within the wall and roof systems as needed and where shown on the drawings.

.1 Galvanized sheet steel with full strength fluoropolymer coating.

.1 Gauge: to suit intended purpose but not less than 24 gauge.

.2 Flashings are to be fabricated and installed in accordance with the SMACNA Architectural Sheet Metal Manual.

2.5 ANCILLARY MATERIALS

.1 Solder: ASTM B32, alloy composition Sn 50.

.2 Soldering Flux: ASTM B32, Type RA.

.3 Sealer Tape: Polyisobutylene sealer tape specifically manufactured for lap sealing.

.4 Isolation Paint: ASTM D1187, asphalt.

.5 Joint Sealants: As specified in Section 07900 - Joint Sealants.

.6 Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 0.5 mm thick minimum polyester.

.7 Fasteners:

.1 For Galvanized Steelwork: Steel, galvanized per ASTM A153/A153M or stainless steel fasteners.

.1 Colour matched to flashing.

2.6 FABRICATION OF FLASHING

.1 Field measure prior to fabrication.

.2 Accurately form flashings to shapes shown and detailed, with angles and lines in true alignment.

.3 Form arris and angles true to line and surfaces free of waves and buckles.

.4 Form bends to 1.59 mm inside radius.

.5 Hem exposed edges.

.6 Reinforcements and Supports: Provide same material as flashing, unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.

.7 Rigid Joints and Seams: Make mechanically strong. Seal aluminum joints with sealant. Solder galvanized and stainless steel metal joints. Do not use solder to transmit stress.

.8 Fabricate sheet metal in 3 meters maximum lengths, unless otherwise indicated.

.9 At exposed ends of counterflashing furnish weathertight closures.

.10 Fabricate corners in one piece with legs extending 900 mm each way to field joint. Lap, rivet, and solder corner seams watertight.

.11 Neutralize soldering flux.

.12 Solvent clean sheet metal. Surfaces to be in contact with roofing or otherwise concealed shall be coated with isolation paint.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install reglets, counterflashing, scuppers, conductor heads, downspouts and miscellaneous flashings in accordance with the SMACNA Architectural Sheet Metal Manual.

.1 Reglets and Counterflashing: Install in accordance with manufacturer’s printed instructions.

.2 Build in flashings in masonry in accordance with CAN/CSA A371 as follows:

.1 Install flashings under the exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep-hole courses and as indicated in the Contract Documents.

.3 Flashing:

.1 Coordinate flashing Work with cladding and roofing Work for weathertight and watertight assembly.

.2 Isolate metal from wood and concrete and from dissimilar metal with isolation tape or two coats of isolation paint.

.3 Use only stainless steel fasteners to connect isolated dissimilar metals.

.4 Joints: 3000 mm maximum spacing and 762 mm from corners, butted with 4.8 mm space centered over matching 200 mm long backing plate with sealer tape in laps.

.5 Set flanges of flashings and roof accessories on continuous sealer tape or in plastic roof cement on top of envelope ply of roofing. Nail flanges through sealer tape and at 76 mm maximum spacing. Touch up isolation paint on flanges.

.6 Joints, Fastenings, Reinforcements, and Supports: Sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.

.7 Provide continuous holddown clips where needed and where shown on the drawings.

.8 Conceal fastenings wherever possible.

.9 Set flashing and sheet metal to straight, true lines with exposed faces aligned in proper plane without bulges or waves.

3.2 FINISH

.1 Exposed Surfaces of Flashing: Free of dents, scratches, abrasions, or other visible defects.

END OF SECTION

SECTION 07900
JOINT SEALANTS

SECTION 07900
JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 07465 - Preformed Metal Cladding

.2 Section 07620 - Sheet Metal Flashing and Trim

.3 Section 08110 - Metal Doors and Frames

.4 Section 09900 - Painting

1.2 REFERENCE STANDARDS

.1 Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C920 Standard Specification for Elastomeric Joint Sealants

.2 ASTM C1193 Standard Guide for Use of Joint Sealants

1.3 SUBMITTALS

.1 Samples for Initial Selection: Provide 150 mm long cured, colour samples of manufacturer's standard range of colours in each type of sealant for selection by Owners Representative. Submit samples of primer, bond breaker tape and joint backing material, if requested.

.2 Product Data: Submit product information from sealant manufacturers prior to commencement of work of this Section verifying:

.1 Selected sealant materials are from those specified.

.2 Composition and physical characteristics.

.3 Surface preparation requirements.

.4 Priming and application procedures.

.5 Suitability of sealants for purposes intended and joint design.

.6 Test report on adhesion, compatibility and staining effect on samples of materials used on Project.

.7 Sealants compatibility with other materials and products with which they come in contact including but not limited to sealants provided under other Sections, insulation adhesives, bitumens, brick, stone, concrete, masonry, metals and metal finishes, ceramic tile, plastic laminates, paints.

.8 Suitability of sealants for temperature and humidity conditions at time of application.

1.4 QUALITY ASSURANCE

.1 Installer: Trained and approved by the manufacturer and having a minimum five 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.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in original, unopened containers with manufacturer's labels identifying manufacturer's name, brand name of product, 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 flammable materials in safe, approved containers to eliminate fire hazards.

.3 Do not use sealing materials that have been stored beyond the maximum recommended shelf life.

1.6 PROJECT CONDITIONS

.1 Environmental Requirements: Do not apply any sealant under adverse weather conditions, when joints to be sealed are damp, wet or frozen or when at ambient temperatures below 5 deg C (40 deg F). Maintain minimum temperature of application during application and for 8 hours after application. Consult manufacturer for specific instructions before proceeding and obtain Owners Representatives approval.

1.7 WARRANTY

.1 Submit a 2 year warranty for the work of this Section against defects in materials and workmanship.

.1 Warrant work of this Section against defects and deficiencies including cracking, crumbling, melting, shrinkage, sag, failure in adhesion, cohesion or reversion, air and moisture leakage, marbling or streaking due to

improper mixing, discolouration due to dirt pick-up during curing and staining of adjacent materials.

.2 Warranty Period: Commencing upon the date of Substantial Performance of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

.1 General: Non-bleeding, non-migrating, capable of supporting their own weight.

.1 Horizontal Joints: Self levelling.

.2 Vertical and Overhead Joints: Non-sag.

.2 Sealant Type A: ASTM C920 Type S, Grade NS, Class 25, Use NT, M, A and O, one component, moisture curing, urethane base, Sikaflex 1a by Sika, or Dymonic/ Dymonic FC by Tremco.

.3 Sealant Type B: ASTM C920 Type S, Grade NS, Class 100/50, Use NT, M, G, A and O, ultra low-modulus, one component, moisture curing, silicone, Sikasil WS-290 by Sika, or Spectrem 1 by Tremco.

.4 Sealant Type C: ASTM C920 Type M, Grade P, Class 25, Use T, M, A, O and I, multi-component, chemical curing, polyurethane, self-levelling, Sikaflex 2c SL by Sika, or Vulkem 245 by Tremco.

.5 Sealant Type D: ASTM C920 Type S, Grade NS, Use NT, G, A and O, one component, chemical curing, mildew resistant silicone, DC786 by Dow Corning, Sanitary 1700 by GE Silicones, or Tremsil 200 by Tremco.

.6 Non-Skinning Butyl Sealant: TremPro JS-773 Non-Skinning, Non-Drying, Flexible, Synthetic Butyl Sealant by Tremco or approved equal.

.7 Acoustic sealant: conform to CAN/CGSB-19.21.

.8 Joint Backing: Preformed, compressible, resilient, non-waxing, non-extruding, non-staining closed cell polyethylene or urethane foam, shape to suit intended use, oversize 25% and compatible with sealant, primer and substrate.

.9 Bond Breaker Tape: As recommended by sealant manufacturer.

.10 Joint Primer: Non-staining, suitable for substrate surfaces, compatible with joint sealants and as recommended by sealant manufacturer.

.11 Cleaning Material: Non-corrosive, non-staining, xylol, methyl ethyl ketone, toluol, isopropyl alcohol or as recommended by sealant manufacturer and

acceptable to material or finish manufacturers for surfaces adjacent to sealed areas.

.12 Sealants, Cleaning Materials and Primers: Compatible with each other.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Ensure joints are suitable to accept and receive sealants. Commencement of work implies acceptance of surfaces and conditions.

.2 Do not apply sealant to masonry until mortar has cured.

.3 Before any sealing work is commenced, test materials for indications of staining or poor adhesion.

3.2 PREPARATION

.1 Clean joints and spaces which are to be sealed and ensure they are dry and free of dust, loose mortar, oil, grease, oxidation, coatings, form release agents, sealers and other foreign material.

.2 Clean porous surfaces such as concrete, masonry or stone by wire brushing, grinding or sandblasting as required to obtain clean and sound surfaces.

.1 Remove laitance by grinding or mechanical abrading.

.2 Remove oils by abrasive blast cleaning.

.3 Remove loose particles present or resulting from grinding, abrading or sandblast cleaning by thorough brushing.

.3 Clean ferrous metals of rust, mill scale and foreign materials by wire brushing, grinding or sanding.

.4 Wipe non-porous surfaces such as metal and glass to be sealed, except pre-coated metals, with cellulose sponges or clean rags soaked with ethyl alcohol, ketone solvent, xylol or toluol and wipe dry with clean cloth.

.1 Where joints are to be sealed with silicone based sealants clean joint with methyl ethyl ketone or xylol. Do not allow solvent to air-dry without wiping.

.2 Clean pre-coated metals with solutions or compounds which will not injure finish and which are compatible with joint primer and sealant.

.5 Install joint backing material to achieve correct and uniform joint profile.

.6 Where joint design or depth of joint prevents use of joint backing material, apply bond breaker tape to prevent three-sided adhesion.

.7 Do not stretch, twist, puncture or tear joint backing. Butt joint backing at intersections. Install bond breaker tape at back of joint where joint backing is not required or cannot be installed.

.8 On horizontal traffic surfaces, support joint filler against vertical movement, which might result from traffic loads, including foot traffic.

.9 Where surfaces adjacent to joints are likely to become coated with sealant during application, mask them prior to priming and sealing.

.10 Do not exceed shelf life and pot life of materials, and installation times, as stated by manufacturers.

.11 Be familiar with work life of sealant to be used. Do not mix multiple component materials until required for use.

.12 Use materials as received from manufacturer, without additions, deletions and adulterations of materials.

.13 Mix multiple component sealants and bulk sealants using mechanical mixer capable of mixing without mixing air into material, strictly in accordance with manufacturer's directions and recommendations. Continue mixing until material is homogeneously blended, uniform in colour and free from streaks of unmixed material. Install compound prior to start of hardening or curing cycle.

.14 Seal joints in surfaces to be painted before surfaces are painted. 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 they are incompatible, inform Owners Representative and change primer and sealant to compatible types approved by Owners Representative.

.15 Where irregular surface or sensitive joint border exists, apply masking tape at edge of joint to ensure joint neatness and protection.

.16 Prime joints as required by sealant manufacturer. Prime sides of joints for type of surface being sealed prior to application of joint backing, bond breaker or sealant.

3.3 APPLICATION

.1 Apply sealant using hand operated guns or pressure equipment fitted with suitable nozzle size and equipment approved by sealant manufacturer. Apply in accordance with manufacturer's directions and recommendations.

.2 Force sealant into joint and against sides of joints to obtain uniform adhesion. Use sufficient pressure to completely fill all voids in joint regardless of variation

in joint widths and to proper joint depth as prepared. Ensure full firm contact with interfaces of joint. Superficial pointing with skin bead shall not be acceptable.

.3 Finish face of compound to form smooth, uniform beads. At recesses in angular surfaces, finish compound with flat face, flush with face of materials at each side. At recesses in flush surfaces, finish compound with concave face flush with face of materials at each side.

.4 Compound may be tooled, provided that such tooling does not damage seal or tear compound. Avoid pulling of sealant from sides.

.5 Tool surfaces as soon as possible after sealant application or before any skin formation has occurred, particularly when using silicone sealants.

.6 Joint surfaces shall be straight, neatly finished, free from ridges, wrinkles, sags, dirt, stains, air pockets and embedded foreign matter or other defacement and be uniform in colour, free from marbling and/or colour streaking due to improper mixing or use of out of shelf life products.

3.4 SEALANT SCHEDULE

.1 Use one of sealants specified for each type in following locations. Ensure sealant chosen for each location is recommended by manufacturer for use for conditions encountered.

.2 Refer to Drawings for sealing work not specifically listed in this Section.

.3 Seal following joints with Sealant Type A:

.1 Interior non-rated masonry and gypsum, cement board control joints.

.2 Interior top of non-rated masonry walls to structure above.

.3 Interior hollow metal door, window and screen frames, both sides.

.4 Seal following joints with Sealant Type B:

.1 Precast concrete panel joints.

.2 Exterior hollow metal doors, windows and louvers, both sides.

.3 Penetrations through exterior walls.

.4 Joints between thresholds and slabs.

.5 Exterior control joints in masonry.

.6 Expansion joints (vertical and overhead joints).

.5 Seal following joints with Sealant Type C:

.1 Expansion joints (horizontal joints).

.6 Seal following joints with Sealant Type D:

.1 Around pipes and conduits passing through walls and ceilings in washrooms. Conceal sealant with escutcheons.

.2 Joints between urinals and walls in washrooms.

.3 Joints between water closets and walls in washrooms.

.4 Joints between wall mounted lavatories and walls in washrooms.

.5 Joints between access panels and walls.

.7 Non-Skinning Butyl Sealant: Where shown on the drawings.

3.5 REPAIR

.1 Remove any compounds not complying with requirements specified herein. Exercise care in removal operations not to mar or damage finishes adjacent to joints. Repeat preparation, priming and installation of new material as specified to provide finished work complying with specified requirements and acceptable to Owners Representative. Do such repair work at no extra cost to Owner.

3.6 CLEANING

.1 Immediately clean adjacent surfaces, which have been soiled and leave Work in neat, clean condition. Remove excess materials, compounds smears or other soiling resulting from application of sealants. Use recommended cleaners and solvents.

3.7 PROTECTION OF COMPLETED WORK

.1 Provide approved, non-staining means of protection for completed joint sealant installations where required to protect work from mechanical, thermal, chemical and other damage by construction operations and traffic.

.2 Maintain protection securely in place until completion of Work. Remove protection when so directed by the Owners Representative.

END OF SECTION

DIVISION 8

DOORS AND WINDOWS

SECTION 08110
STEEL DOORS AND FRAMES

SECTION 08110
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 07900 Joint Sealants

.2 Section 08710 - Door Hardware

.3 Section 09900 - Painting

1.2 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A 653M-95 – Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated Galvannealed by the Hot-Dipped Process

.2 ASTM B 29-92 – Specification for Pig Lead

.3 ASTM B 749-851991 – Specification for Lead and Lead Alloy Strip, Sheet and Plate Products

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181-92 – Ready-mixed Organic Zinc-Rich Coating

.2 CAN/CGSB-51.20-M87 – Thermal Insulation, Polystyrene, Boards and Pipe Coverings

.3 Canadian Standards Association (CSA):

.1 CSA A101-M1983 – Thermal Insulation, Mineral Fibre, for Buildings

.2 CAN/CSA-G40.21-M92 – Structural Quality Steels

.3 CSA W59-M1989 – Welded Steel Construction Metal Arc Welding

.4 Canadian Steel Door and Frame Manufacturer's Association (CSDFMA):

.1 CSDFMA – Specifications for Commercial Steel Doors and Frames, 1990

.2 CSDFMA – Recommended Selection and Usage Guide for Commercial Steel Doors, 1990

.5 National Fire Protection Association (NFPA):

.1 NFPA 80 – Fire Doors and Windows

.2 NFPA 252 – Door Assemblies, Fire Tests of Door Assemblies

.6 Underwriters' Laboratories of Canada (ULC):

.1 CAN4-S104M-M80R1985 – Fire Tests of Door Assemblies

.2 CAN4-S105M-M85 – Fire Door Frames

1.3 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate for expansion and contraction when subjected to minimum and maximum surface temperature of –35°C to 35°C.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01330 – Submittal Procedures.

.2 Indicate each type of door, material, steel core thickness, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvered, arrangement of hardware and fire rating and finishes.

.3 Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating finishes.

.4 Include schedule identifying each unit with door marks and numbers.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by the Standards Council of Canada in conformance with CAN4-S104M NFPA 252 for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 and list by nationally recognized agency having

factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

.1 Materials

.1 Hot-dipped galvanized steel sheet: to ASTM A 653M, ZF75.

.2 Reinforcement channel: to CAN/CSA-G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

.2 Door Core Materials

.1 Stiffened: face sheets welded, insulated core.

.2 Temperature Rise Rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at 30 to 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E 152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized agency having factory inspection service.

.3 Thermal insulation material must not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.

.4 Adhesives

.1 Select adhesives that are accompanied by:

.1 Detailed instructions for proper application, so as to minimize health concerns and maximize performance; and information describing proper disposal methods for containers.

.5 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Primers

.1 Touch-up primer: to CAN/CGSB-1.181.

.4 Paint

.1 Steel doors and frames shall be field painted in accordance with Section 09900 – Painting. Weatherstripping shall be protected from paint. Finish shall be free of scratches or other blemishes.

.5 Accessories

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: steel.

.3 Door bottom seal: to Section 08710 - Door Hardware.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal riveted.

.6 Sealant: to Section 07900 – Joint Sealants.

.6 Frames Fabrication General

.1 Fabricate frames in accordance with CSDFMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm welded type construction.

.4 Interior frames: 1.6 mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware and electronic hardware using templates provided by finish hardware supplier. Reinforce frames from surface mounted hardware.

.6 Protect mortised cut-outs with steel guard boxes.

.7 Prepare frame for door silencers, three (3) for single door, two (2) at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings, except where exposed fastenings are indicated.

.10 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with polyurethane insulation.

.12 Prepare frames for electrical devices, including operators and security devices.

.13 Reinforce head of frames wider than 1200 mm.

.7 Frame Anchorage

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide two (2) anchors for rebate opening heights up to 1520 mm and one (1) additional anchor for each additional 760 mm of height or fraction thereof.

.4 Provide three (3) jamb anchors per jamb for frames in masonry up to 2286 mm high and one (1) additional for each 600 mm over 2886 mm high for doors up to 900 mm wide.

.5 Provide five (5) jamb anchors per jamb for frames in masonry up to 2286 mm high and one (1) additional for each 400 mm over 2286 mm for doors over 900 mm wide, unless noted otherwise.

.8 Frames – Welded Type

.1 Welded in accordance with CSA W59.

.2 Accurately metre or mechanically join frame product and secure weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane; fill with metallic paste; and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Securely attach lead to inside of frame profile from return to jamb soffit, inclusive on door side of frame only.

.9 Door Fabrication General

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: hollow steel construction.

.3 Interior doors: hollow steel construction.

.4 Fabricate doors with longitudinal edges welded.

.1 Seams: grind welded joints to a flat plane; fill with metallic paste filler; and sand to a uniform smooth finish.

.5 Blank, reinforce, drill doors and tap for mortised, template hardware and electronic hardware.

.6 Factory prepares holes 12.7 mm diameter and larger, except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/ Factory Inspection Manuals issued by listing agency to individual manufacturers.

.10 Manufacturer's nameplates on doors are not permitted.

.10 Hollow Steel Construction

.1 Form each sheet for exterior doors from 1.6 mm sheet steel.

.2 Form each face sheet for interior doors from 1.6 mm steel.

.3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.

.4 Hardware Reinforcing: 1.6 mm minimum.

.5 Floor anchors: 1.6 mm minimum.

.6 Channel spreaders: 1.2 mm minimum.

.7 Guard boxes: 0.9 mm minimum.

.8 Hinge reinforcing: 5.2 mm minimum.

.9 Glass moulding: 0.9 mm minimum.

.10 Jamb anchors: 1.6 mm minimum.

.11 Top, bottom, door and channel: 1.2 mm minimum.

.12 Frame members: 1.6 mm minimum.

.13 Fill voids between stiffeners of exterior doors with polyurethane core.

.14 Fill voids between stiffeners of interior doors with fibreglass core.

2.2 EXTERIOR DOORS

.1 44mm thick Trio-E hollow metal doors manufactured by Fleming or approved equal.

.1 Door face sheets: 16 gauge.

.1 A60 galvannealed steel conforming to ASTM A653.

.2 Seamless: No seams visible on faces or vertical edges.

.3 Steel stiffened laminated core with polyurethane filler.

.1 Stiffeners: 22 gauge, spaced at 160mm on center.

.2 Polyurethane insulation core shall fill the entire door cavity and be chemically bonded to all interior surfaces.

.1 U-factor of 0.36

.4 Frames: Welded type, 16 gauge.

.1 A60 galvannealed steel conforming to ASTM A653.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80, except where specified otherwise.

.2 Install forced entry resistant security doors as per ANSI/NAAMM HMMA 862-13 “Guide Specifications”.

.1 Frame jambs are to be fully grouted to provide added security.

.3 Install doors and frames to CSDFMA Installation Guide.

3.2 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structures to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08710 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows:

.1 Hinge side: 1.0 mm.

.2 Latch side and head: 1.5 mm.

.3 Finished floor, top of thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.4 FINISH REPAIRS

.1 Touch-up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

SECTION 08520
ALUMINIUM WINDOWS

SECTION 08520
ALUMINIUM WINDOWS

PART 1 GENERAL

1.1 SUMMARY

.1 Supply and install aluminum windows, glazing and accessories as indicated on the drawings, as specified herein and as required to complete the work.

1.2 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 07620 – Sheet Metal Flashing and Trim

.2 Section 07900 – Joint Sealants

1.3 REFERENCE STANDARDS

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 Aluminum Association (AA):

.1 DAF 45, Designation System For Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA):

.1 AAMA-501, Methods of Test for Exterior Walls.

.2 AAMA-2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

.3 AAMA CW DG-1, Aluminum Curtain Wall Design Guide Manual.

.4 AAMA CW-10, Care and Handling of Architectural Aluminum From Shop to Site.

.5 AAMA CW-11, Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.

.3 ASTM International (ASTM):

.1 ASTM A653 / A653M – [09a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 ASTM B221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

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

.5 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.

.6 ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.7 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.

.8 ASTM E547, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference

.9 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.

.10 ASTM D2240, Standard Test Method for Rubber Property—Durometer Hardness.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-12.1-M Tempered or Laminated Safety Glass

.2 CAN/CGSB-12.3-M Flat, Clear Float Glass

.3 CAN/CGSB-12.8, Insulating Glass Units.

.5 CSA International (CSA):

.1 CAN/CSA-S157, Strength Design in Aluminum.

.2 CAN/CSA-S136, North American Specification for the Design of Cold-Formed Steel Structural Members.

.3 CAN/CSA W59.2, Welded Aluminum Construction.

.6 Environmental Choice Program (ECP):

.1 CCD-45, Sealants and Caulking Compounds.

.7 Ontario Building Code (OBC)

.8 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S710.1, Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials Standard for Thermal Insulation - Bead - Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials.

.9 Glass Association of North America (GANA)

.1 GANA Glazing Manual

1.4 SUBMITTALS

.1 Shop drawings to bear professional seal or stamp and signature of a professional engineer licensed to design structures in the Province of Ontario.

.1 Include on the shop drawings:

.1 Component dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding if required. Indicate location of manufacturer's nameplates.

.2 Indicate material being supplied, wall thickness of sheet and extrusions, and finish specification.

.3 Indicate connections, attachments, stiffening's, anchorage and location of anchors and fastenings. Provision for thermal and structural movement between components of this Section and between components of this Section and adjacent materials.

.4 Indicate air-seal details.

.5 Engineering analysis and/or testing to exhibit compliance with the seismic requirements of the Ontario Building Code

.2 Manufacturers catalogues and/or brochures.

.3 Test Reports:

.1 Submit test reports showing compliance with specified performance characteristics and physical properties including air infiltration, water infiltration and structural performance.

.4 Submit manufacturer's installation and maintenance instructions for each item of hardware.

.5 Installer Qualifications:

.1 Submit letter verifying installer’s experience with work similar to work of this Section.

.6 Closeout Submittals:

.1 Operation and Maintenance Data: Supply maintenance data for incorporation into O&M Manual.

.2 Executed warranty documents.

1.5 SAMPLES:

.1 Submit hard-copy colour chart of available prefinished colours for aluminum curtain wall components for initial colour selection.

.1 Upon initial colour selection by the Owner, submit samples of prefinished aluminum for final acceptance.

.2 Submit sample of complete IGU’s to site for review and approval.

.1 Samples are to be no smaller than 300 mm x 300 mm and are to include acid-etched visual markers.

1.6 DESIGN REQUIREMENTS

.1 Windows shall be designed to withstand wind load/suction expected in the building’s geographical region as per OBC SB-1 Climatic Data, 1/50-year probability to maximum deflection of 1/175 of clear span.

.2 Structural performance shall be based on Aluminum Association "Specification for Aluminum Structures" or CSA Standard CAN3-S157 "Strength Design in Aluminum". There shall be no deflection in excess of L/175 of the span of any framing member at design load.

.3 Windows and their connection to the structure are to be designed and detailed as per the seismic requirements stated in Ontario Building Code (OBC) 4.1.8.18.

.4 Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.2 l/s m² at a static air pressure differential of 300 Pa.

.5 Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 10 psf (479 Pa) as defined in AAMA 501.

.6 Water Resistance, (dynamic): The test specimen shall be tested in accordance with ASTM E547 and shall have no uncontrolled water penetration.

.7 Design sections to accommodate expansion and contraction when subject to minimum and maximum surface temperature of 35°C to 45°C. Make allowance for deflection to ensure that structural loads are not transmitted to aluminum work.

1.7 QUALITY ASSURANCE

.1 Installer Qualifications: An installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.

.1 Installer is to have minimum 2 years experience in work similar to the work of this Section.

.2 Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

.3 Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

1.8 WARRANTY

.1 Submit warranty for work of this Section against defects in materials and manufacturing including but not limited to:

.1 No condensation on inside face of insulating glass or frame at 40% RH at +20°C inside and 20°C outside.

.2 Loosening of glazing.

.3 Water penetration beyond air seal.

.4 Fading, discolouration or evidence of other defects of metal finish.

.5 Failure of glazing system.

.6 Failure of seals or gaskets.

.7 Performance failure of any metal component.

.2 Submit window manufacturer's two-year warranty against defects in materials and workmanship for the window frames and associated components.

.3 Submit glazing manufacturers ten-year warrant against defects in materials and workmanship for the glazing units.

.4 Submit two-year warranty from the Installer against defects in the window installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable manufacturers:

.1 Basis of design: Alumicor Limited.

.2 Or approved equal by:

.1 Kawneer Company.

.2 Windspec Inc.

2.2 ALUMINUM WINDOWS

.1 Basis-of-design System: Rainblade 1970 Series by Alumicor.

.1 Finish:

.1 Exterior Finish: To AAMA 2605, 70% PVDF fluoropolymer coating.

.2 Interior Finish: To AA-M10C22A41, Class 1 Clear Anodized.

.2 Incorporate a drained and vented system complete with air and vapour seal, allowing any water entering the framing/system and the glazing detail cavities to drain to the exterior and also allowing air into the pressuring chamber.

.3 Provide windows that incorporate a thermal break.

.4 Material: Extruded Aluminum, ASTM B 221, 6063-T6 alloy and temper.

.5 Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.

2.3 GLAZING

.1 Manufacturer:

.1 Vitro Architectural Glass.

.2 Or approved equal.

.1 Alternate manufacturers must have available products that meet the visual and performance characteristics of the specified manufacturers IGU's.

.2 25mm insulating glazing unit (IGU), tinted:

.3 Exterior pane: 6 mm thick, fully tempered, tinted, low reflective glass with acid-etched visual markers.

.1 Product (basis-of-design): Optigray by Vitro Glass.

.2 Acid-etched visual markers on surface 1.

.1 Visual markers are to be min. 5mm diameter opaque dot contrasting markers spaced at 100mm on center both horizontally and vertically.

.3 Glass to have less than 15% reflectance.

.4 Air space: 12 mm.

.5 Interior pane: 6 mm thick, fully tempered, low reflective glass with low-E coating on surface 3.

.1 Product (basis-of-design): Solarban 70 clear by Vitro Glass.

.2 Glass to have less than 15% reflectance.

2.4 ACCESSORIES

.1 Provide all accessories needed to complete the work including:

.1 Fasteners:

.1 Tamperproof, cadmium plated stainless steel to meet window requirements and as recommended by manufacturer.

.2 Gaskets:

.1 To CCD-45 Black EPDM gaskets.

.3 Setting Blocks:

.1 To CCD-45 and ASTM D2240, EPDM, neoprene or silicone, 80 - 90 Shore A Durometer hardness.

.4 Spacers:

.1 To CCD-45 and ASTM D2240, EPDM, neoprene or silicone, 50 - 60 Shore A Durometer hardness.

.5 Liquid foam insulation:

.1 Single component, moisture cure, low expansion rate spray-in-place polyurethane liquid foam insulation to ULC-S710.1 and in accordance with manufacturer's written recommendations.

.6 Sealants:

.1 To Section 07900 – Joint Sealants.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS/RECOMMENDATIONS

.1 Compliance: Comply with manufacturer's product installation data and recommendations for installation requirements of window units, hardware, and other components in accordance with manufacturer's warranty provisions.

3.2 EXAMINATION

.1 Site verification of conditions: Verify that existing substrate conditions are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive window units and sill plate is level in accordance with manufacturer's acceptable tolerances.

.2 Field Measurements: Verify field measurements for window installation.

3.3 INSTALLATION

.1 General: Install window units plumb, level, and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances.

.2 Provide support and anchor in place.

.1 Dissimilar Materials: Provide separation of aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points by complying with AAMA 101, Appendix, titled "Dissimilar Materials."

.2 Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction. Coordinate installation with wall flashings and other components of construction.

.1 Refer to Section 07900 Joint Sealants.

.3 Install miscellaneous steel reinforcing of aluminum frames where required.

3.4 CLEANING AND PROTECTION

.1 Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to the Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

.2 Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum windows from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum window.

END OF SECTION

SECTION 08710
DOOR HARDWARE

SECTION 08710
DOOR HARDWARE

GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 01300 – Submittals

.2 Section 01780 – Contract Closeout

.3 Section 13720 – Access Control

.4 Division 16

1.2 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

.1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturer's Association.

.2 ANSI/BHMA A156.2 - Bored and Pre-assembled Locks and Latches (latest edition)

.3 ANSI/BHMA A156.1 - Butts and Hinges (latest edition)

.4 ANSI/BHMA A156.3 - Exit Devices (latest edition)

.5 ANSI/BHMA A156.4 - Door Controls (Closers) (latest edition)

.6 ANSI/BHMA A156.5 – Cylinders and Input Devices for Locks (latest edition)

.7 ANSI/BHMA A156.6 - Architectural Door Trim (latest edition)

.8 ANSI/BHMA A156.7 - Template Hinge Dimensions (latest edition)

.9 ANSI/BHMA A156.8 - Door Controls – Overhead Stops & Holders (latest edition)

.10 ANSI/BHMA A156.13 - Mortise Locks and Latches (latest edition)

.11 ANSI/BHMA A156.15 - Release Devices (latest edition)

.12 ANSI/BHMA A156.16 - Auxiliary Hardware (latest edition)

.13 ANSI/BHMA A156.18 - Materials and Finishes (latest edition)

1.3 REQUIREMENTS REGULATORY AGENCIES

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.4 SUBMITTALS

.1 Hardware Schedule

.1 Submit detailed door and hardware schedule indicating all hardware for each door.

.2 Schedule is to include make, model, material, function, size, finish and other pertinent information for all hardware.

.3 Submit product data sheets, brochures, etc. for all hardware.

.2 Maintenance Data

.1 Provide operation and maintenance data for door closers, locksets, door holders and fire exit hardware for incorporation into manual specified in Section 01780 – Contract Closeout.

.2 Brief maintenance staff regarding proper care, cleaning and general maintenance.

.3 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 01780 – Contract Closeout.

.2 Supply two (2) sets of wrenches for door closers locksets and fire exit hardware.

1.5 DELIVERY AND STORAGE

.1 Store finishing hardware in locked, clean and dry area.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

PART 2 PRODUCTS

2.1 HARDWARE ITEMS

.1 Only door locksets and latches listed on CGSB Qualified Products List are acceptable for use on this project.

.2 Use one manufacturer's products only for all similar items.

.3 All hardware mounted on fire rated doors and frames to be UL listed.

2.2 DOOR HARDWARE

.1 Locks and Latches:

.1 Finished to 626.

.2 Locksets and latch sets on fire rated doors to be UL listed.

.3 Acceptable products:

.1 Latchsets: Schlage #ND10S X RHO X ASA X 626.

.2 Storeroom Locksets: Schlage #ND80PD X RHO X ASA X 626.

.3 Office Lockset: Schlage #ND50PD X RHO X ASA X 626.

.4 Privacy Lockset: Schlage #ND40S X RHO X ASA X 626.

.5 Exit Lockset: Schlage #ND25D X RHO X ASA X 626.

.6 Lockset functions to be confirmed by Owner.

.4 Keying system:

.1 In conjunction with Section 13720, coordinate with Owners and Owners locksmith for requirements related to key cylinder/core.

.2 Butts and hinges:

.1 Hinges for exterior doors to have non-removable pins.

.2 Hinges shall be Stanley and Hager as an accepted equal only. Provide one (1) hinge for every 760 mm of door height and one (1) extra hinge for doors between 900 mm wide to 1200 mm width.

.1 Exterior Hinges: Full mortise, Stanley FBB199 X 114 X 114 X NRP X 630.

.2 Interior Hinges: Full mortise, Stanley CB179 X 101 X 101 X 630.

.3 Exit devices:

.1 Panic Devices: Von Duprin 98 Series, 630 finish.

.1 Lever on pull side to match Schlage RHO lever.

.4 Door closers and accessories:

.1 Acceptable product:

.1 Exterior Closers: LCN #4040XP Series.

.2 Interior Closers: LCN #4040XP Series.

.2 Closers on fire rated doors to be UL listed.

.3 Doors requiring hold opens and overhead stops are to be incorporated into closer arms.

.4 Include drop plates where required when door head has wall opening wider than frame width or where ceiling is at door head.

.5 Finish: 628 finish.

.5 Door Operators:

.1 Power operated pedestrian doors: to ANSI Standards A117.1, A156.19 and the ADA.

.2 Device shall be by LCN or approved equal

.3 Actuator to be 8310-856T, 4 ½", surface mounted.

.6 Architectural Door Trim:

.1 Door protection plates: Hager #198S x length of door (minus 50 mm) x 203(H) x 630 finish.

.2 Push plates: Hager #80S x 102(L) x 406(H) x 630 finish.

.3 Pull plates: Hager #31E x 102(L) x 406(H) x 630 finish.

.4 Lock Guards: Latch Protector by Don-Jo, 630 finish.

.7 Auxiliary hardware:

.1 Floor Stops: Hager #241F x 626 finish.

.2 Flush Bolts: Ives FB358 (UL) x 626 finish.

.8 Thresholds:

.1 Width of threshold to suit door frame x full length of door opening, extruded aluminum, MIL finish.

.2 Thresholds at exterior doors to be complete with thermal break.

.3 Thresholds at fire rated doors to be UL listed.

.4 Acceptable manufacturers:

.1 Hager

.2 K.N Crowder

.3 Pemko

.9 Weather-strips/gaskets, astragals, door sweeps, automatic door bottoms:

.1 Seals on fire rated doors to be UL listed.

.2 Gasketting

.1 Provide smoke seals (jambs, head, bottom and astragal) to all doors within exit stair wells. Smoke seal gaskets to be silicone/silicone inserts and rated to UL 1784.

.2 Air leakage gaskets, where called for in the drawings on the door schedule, are to be tested to ASTM E-283. Provide gasketing around entire perimeter of door and, on pairs of doors, at meeting edge.

.3 Acceptable manufacturers:

.1 Pemko

.2 K.N Crowder

.4 Head and jamb weather-stripping:

.1 Extruded aluminum frame and compression bulb neoprene insert.

.2 Finish: 628.

.5 Door sweep:

.1 Extruded aluminum frame and nylon brush insert.

.2 Finish: 628.

.6 Automatic door bottom

.1 Extruded aluminum frame and compression bulb neoprene insert

.2 Surface mounted.

.3 Finish: 628.

2.3 MISCELLANEOUS HARDWARE

.1 Miscellaneous Trim Hardware: shall be as manufactured in Canada, wherever possible, in 630 stainless steel #316.

2.4 FASTENINGS

.1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.2 Exposed fastening devices to match finish of hardware.

.3 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices and install so pull can be secured through door from reserve side. Install push plate to cover fasteners.

.4 Use fasteners compatible with material through which they pass.

2.5 KEYING

.1 The Contractor is to design, supply and install the keying system in conjunction with specification Section 13720.

.2 Coordinate with the Owner and Owners locksmith for requirements related to key cylinder/core.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

.1 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.2 Furnish manufacturer's instructions for proper installation of each hardware component.

.3 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.4 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.5 Wiring and controls for electrical components shall be in accordance with manufacturer's instructions:

.1 Division 16 provides empty conduit from controller to devices.

.2 Division 16 provides power to controller.

.3 This section provides all control and power wiring from controller to devices.

3.2 HARDWARE SCHEDULE

.1 See Door Schedules on drawings for hardware requirements.

.2 General requirements: Door hardware general requirements listed below overrule the door schedule shown on drawings if conflicting information is given.

.1 Lockset for washroom door shall be privacy lockset.

.2 Exterior insulated doors shall be complete with weather-stripping and door sweep. Double doors shall have astragal to seal meeting edge of pair of doors.

.3 Door protection plates shall be installed on all doors

.4 Door swing shall not cause door leaf to hit walls. Typically, door closers with integrated door stops shall be provided. Where door doesn't have a door closer or integrated door stop isn't suitable, provide and install floor stops as required to protect doors.

.1 Door closers within barrier free path of travel shall be ADA compliant and shall comply with the OBC for opening force requirements.

END OF SECTION

SECTION 08800
GLAZING

SECTION 08800
GLAZING

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions.

1.2 SUBMITTALS

.1 Submit shop drawings of all components for review and approval. Shop drawings to include product data sheets, and clearly express where each component is to be used.

.2 Submit colour/finish samples for review and approval if requested by the engineer.

1.3 WARRANTY

.1 Warranty insulated glass units against fogging in accordance with the General Conditions, except the period shall be for five years.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Polished Plate or Float Glass: Conform to CAN/CGSB-12.3, glazing quality, 6mm thick.

.2 Wired Glass: Conform to CAN/CGSB-12.11, type: clear polished, wire mesh style: square, 6 mm thick.

.3 Tempered Glass: Fully tempered float glass conforming to CAN/CGSB-12.1, 6 mm thick. Tempered glass to be clear unless specified otherwise.

PART 3 EXECUTION

3.1 GENERAL

.1 Glazing for fire rated closures to conform to NFPA 80.

3.2 WORKMANSHIP

.1 Do glazing according to glass manufacturer and framing manufacturer’s recommendations.

.2 Remove protective coatings and clean contact surfaces with solvent and wipe dry.

.3 Apply primer-sealer to contact surfaces.

.4 Place setting blocks as per manufacturer’s instructions.

.5 Install glass, rest on setting blocks, ensure full contact and adhesion at perimeter.

.6 Install removable stops, without displacing tape or sealant.

.7 Provide edge clearance of 3 mm minimum.

.8 Do not cut or abrade tempered, heat treated or coated glass.

3.3 HOLLOW METAL DOORS AND WINDOWS

.1 Dry method - tape/tape.

.2 Apply glazing tape to permanent stops.

.3 Set glass on setting blocks and press against tape.

.4 Apply glazing tape to perimeter of glass and install removable stop.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09250
GYPSUM BOARD ASSEMBLIES

SECTION 09250
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 WORK INCLUDED

.1 Supply and install all drywall partitions and drywall ceilings, as shown on the Drawings.

1.2 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions.

1.3 REFERENCES

.1 ASTM International (ASTM)

.2 ASTM C36/C36M, Specification for Gypsum Wallboard.

.3 ASTM C475, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.4 ASTM C514, Specification for Nails for the Application of Gypsum Board.

.5 ASTM C630/C630M, Specification for Water Resistant Gypsum Backing Board.

.6 ASTM C840, Specification for Application and Finishing of Gypsum Board.

.7 ASTM C954, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.8 ASTM C1002, Specification for Steel Self Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.9 ASTM C1047, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.10 ASTM C1177, Standard Specification for Glass Mat Gypsum Substrate for use as Sheathing.

.1 ASTM C1280, Specification for Application of Gypsum Sheathing Board.

.11 Association of the Wall and Ceilings Industries International (AWEI).

.12 Canadian General Standards Board (CGSB):

.13 CAN/CGSB 51.34, Vapor Barrier, Polyethylene Sheet for Use in Building Construction.

.14 Underwriters' Laboratories of Canada (ULC):

.15 CAN/ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.5 SITE ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 13°C, maximum 21°C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C36/C36M regular and type X, thickness as shown on the drawings. 1,200 mm wide x maximum practical length, ends square cut, edges bevelled.

.2 Resilient channels: 13mm deep, 0.5 mm base steel thickness, G40 galvanized steel. Secure to concrete block with corrosion resistant concrete screws at no more than 400mm O.C. spacing.

.3 Steel drill screws: to ASTM C1002.

.4 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.5 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.6 Joint compound: to ASTM C475, asbestos-free.

PART 3 EXECUTION

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Do application of gypsum sheathing in accordance with ASTM C1280.

.3 Install work level to tolerance of 1:1200.

.4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, and other protrusions.

.5 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply double layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.

.3 Comply with gypsum board manufacturer's recommendations.

.4 Install gypsum board on walls vertically to avoid end-butt joints.

.5 Install gypsum board with face side out.

.6 Do not install damaged or damp boards.

.7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.3 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre using contact adhesive for full length.

.2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.3 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.4 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:

.5 Levels of finish:

.1 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.2 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.6 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 09900
PAINTING

SECTION 09900
PAINTING

PART 1 GENERAL

1.1 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions.

1.2 REFERENCE STANDARD

.1 Master Painters Institute (MPI) Architectural Painting Specification Manual (MPI Manual).

1.3 QUALIFICATIONS

.1 Qualifications of Applicators:

.1 Work of this section is to be performed by qualified applicators experienced in the type of work to be done.

1.4 SUBMITTALS

.1 Submit a complete list of all materials to the consultant for review before proceeding with the work. List shall state areas or type of surfaces where material is to be applied, name of manufacturer, exact name of product and code number or identification, if applicable.

.2 The Contractor shall submit a Quality Control Inspection and Testing Plan (ITP) detailing the type and frequency of inspection and testing to be performed by the Contractor's QC representative. The ITP plan shall conform to the requirements of this section.

.1 The ITP shall nominate the following minimum hold and witness points:

.1 Surface preparation.

.2 Job conditions (substrate moisture and temperature, ambient temperature, relative humidity, etc.).

.3 After the application of each coat of paint.

.4 Finished work.

.2 Prepare inspection/testing reports to document all observations and test results. Submit reports to the Consultant for review and approval.

.3 Contractors QC representative shall be a NACE CIP Level 2 or Level 3 Certified Coating Inspector.

.3 Samples

.1 Submit two (2) samples of each specified colour.

.1 One (1) sample is to be sent to the Engineers site trailer and one (1) sample is to be sent to the Engineers office.

.2 Colours listed on contract documents are tentative and are not to be considered final. Owner reserves the right to select alternate colours, including custom colours, at their discretion and at no extra cost to the contract.

1.5 MOCK UP

.1 If requested by the Consultant, finish one complete room before proceeding with the remaining work. After approval by the Consultant, this room shall serve as a standard for similar work throughout the building.

1.6 PROTECTION

.1 Use sufficient tarpaulins for the full protection of floors, furnishings and the work of others not being painted in work areas, and in areas assigned for storage and mixing of paint.

.2 Leave such areas clean and free from evidence of occupancy.

.3 Keep waste rags in metal drums and remove same from building at end of each working shift.

.4 Where possible, arrange to have completed areas barred from traffic.

.5 Any finished surfaces which are damaged due to inadequate protection from paint spillage shall be immediately cleaned off to the complete satisfaction of the Consultant. Any surfaces which become permanently damaged shall be replaced to the complete satisfaction of the Consultant.

1.7 JOB CONDITIONS

.1 Do not apply paint systems if the prevailing conditions are outside the Coating Manufacturer’s written recommendations. Conform to the coating manufacturers recommendations, the MPI manual and the following (whichever is most restrictive).

.2 Execute work in dust free conditions suitable for production of best results.

.3 Do not paint exterior surfaces during frost, rainy or foggy weather.

.4 Temperatures:

.1 Do not paint when temperatures on the surface, or the air in the vicinity of the painting work are below the following:

.1 Exterior work: 5°C for solvent base paint; 10°C for water base paint.

.2 Interior work: 5°C for solvent base paint; 7°C for water base paint; 18°C for varnish.

.2 Maintain temperatures and adequately controlled ventilation during drying period on internal surfaces.

.5 Relative humidity:

.1 Do not paint when relative humidity is higher than 85%.

.6 Moisture content of surfaces:

.1 Plaster and gypsum board: maximum moisture content: 12%.

.2 Concrete and masonry: maximum moisture content: 12%.

.3 Wood Maximum Moisture Content – 15%.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Acceptable Products: Acceptable products are those listed in Chapter 5 of the MPI Manuel; MPI Approved Product List.

.2 Materials shall be first grade quality of the respective manufacturer and shall conform to or exceed the appropriate Specification of the 1-GP Series of the Canadian General Standards Board where applicable.

.3 Paint materials for each paint system to be products of a single manufacturer. All materials to be compatible.

.4 All paint shall have Fire Hazard Classification of:

.1 Flame Spread Rating: 25 or less.

.2 Smoke Developed: 50 or less.

.5 Paints shall be factory tinted to required colours, and thoroughly mixed before application.

.6 In instances where materials specified are not suitable for a particular job application or are contrary to Manufacturer's recommendations for use on a particular surface, such condition shall be brought to the attention of the Consultant for clarification and instructions.

PART 3 EXECUTION

3.1 INSPECTION

.1 Inspect surfaces to receive the work of this Section, before and after priming. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

.1 Prepare surfaces to be finished under this Section, in accordance with Chapters 2 and 3 of the MPI Manual and as specified.

.2 Check all surfaces with electric moisture meter to determine whether they are dry enough to receive paint or finish specified and do not proceed if reading is higher than maximum specified without written permission from the Consultant or the Manufacturer's representative.

.3 Check surfaces for excessive alkalinity where necessary. Neutralize surfaces where extreme alkali conditions occur, as recommended by paint material manufacturer.

.4 Proceed with work only when surfaces and conditions are satisfactory for the production of a first class job.

.5 Remove dust, grease, and loose extraneous matter from all surfaces.

.6 Remove loose and flaking paint from previously painted surfaces.

.7 Remove finish hardware, electrical plate and accessories, mask fixture trim as well as any items that are not removable. Replace these when paint is dry. Do not clean hardware with solvent that will remove permanent lacquer finish.

3.3 APPLICATION

.1 Apply all materials according to the manufacturer's printed instructions, MPI Manual and as specified.

.2 Apply materials evenly, uniform in sheen, colour and texture, free from roller or brush marks, sags, runs or other defects.

.3 Any surface exhibiting incomplete or unsatisfactory coverage shall have entire surface re-painted. Patching will not be accepted.

.4 Finishes specified are intended to cover surfaces satisfactorily; if they do not, apply further coats until they do.

.5 Prime coat woodwork soon after woodwork is delivered to the job. Back prime all surfaces before installation.

.6 Prime paint top and bottom of metal doors with enamel undercoater.

.7 Permit paint to dry before applying succeeding coats, touch up suction spots and sand between coats with #00 sandpaper.

.8 Each coat of paint to be slightly darker than the preceding coat unless otherwise approved.

3.4 COLOUR SCHEDULE

.1 Colors shall be selected by the owner from the manufacturer's full range of colors.

3.5 SPECIAL REQUIREMENTS

.1 Remove removable grilles, covers, access panels, for mechanical and electrical systems, from location and paint separately. Paint to match adjacent walls and ceilings, unless otherwise directed, and replace when dry. If items are not removable, mask adjacent areas before painting.

.2 Paint sides of access doors and frames to match the surface in which they occur.

.3 Paint exposed conduit to match colour of surface to which they are anchored.

3.6 MATERIALS AND ITEMS TO BE FINISHED

.1 Finish surfaces as required and as specified. Refer to Room Finish Schedule, Door Schedule and Drawings.

.2 Generally, and not being limited to, the following are items throughout the interior and exterior of the building and on the site that shall be painted or finished as part of the work of this Section.

.1 Exterior:

.1 Galvanized steel bollards.

.2 Steel lintels.

.3 All exterior conduit, ducts and pipes.

.4 All exterior galvanized metal straps, hangers, plates, angles, and brackets.

.5 Steel handrails and guardrails.

.6 Hollow metal doors, door frames, and screens.

.2 Interior:

.1 Concrete block.

.2 All exposed ferrous metal items.

.3 Hollow metal doors, door frames, and screens.

.4 Backboards for electrical and telephone equipment.

.5 Interior exposed galvanized metal straps, hangers, plates, angles and brackets.

.6 All interior conduit exposed to view.

.7 Steel handrails and guardrails.

3.7 MATERIALS AND ITEMS NOT TO BE FINISHED

.1 The following items are not to be painted under this Section:

.1 Stainless steel, aluminum, plated or prefinished metal surfaces.

.2 Plastic Surfaces.

.3 Items supplied with baked enamel finish.

.4 Metal and materials located in concealed duct spaces, pipe tunnels or crawl spaces, except as otherwise noted.

.5 Anodized aluminum grilles and diffusers, pumps, air handling and other manufactured equipment with prefinished surfaces except as otherwise noted.

.6 Insulated pipes concealed from view, copper piping and fittings.

.7 Valves and valve handles.

.8 Nameplates on equipment.

3.8 SCHEDULE OF APPLIED FINISHES

.1 For paint systems, refer to paint systems listed in MPI Manual, Chapters 2 and 3.

.2 All paint systems to be premium grade conforming to MPI Manual unless specified otherwise.

.3 Suitable paint systems are to be used based on environment (humidity, corrosive chemical gases, etc.), level of contract (high traffic areas, low contact area, etc.), substrate (galvanized steel, ferrous metal), etc.

.4 Generally, and not being limited to, the following paint systems are to be used throughout the interior and exterior of the building:

.1 Exterior Paint Systems:

.1 Steel: EXT 5.1N, waterborne light industrial coating over epoxy primer, semi-gloss finish.

.2 Galvanized Steel: EXT 5.3J, waterborne light industrial coating over epoxy primer, semi-gloss finish.

.2 Interior Paint Systems:

.1 Steel: INT 5.1E, alkyd over alkyd metal primer, semi-gloss finish.

.2 Galvanized Steel: INT 5.3C, alkyd over specialty primer, semi-gloss finish.

.3 Concrete Block: INT 4.2K, waterborne light industrial coating over latex block filler primer, semi-gloss finish.

3.9 FIELD QUALITY CONTROL

.1 Per the Inspection and Testing Plan, conduct all necessary inspections and tests to verify installation meets the requirements of the specification. Evidence of defects includes improper thickness and appearance.

.1 If inspection results show materials being used are not in compliance, Contractor may be directed by Consultant to stop work; remove non-complying materials; pay for testing; reapply paint materials to properly prepared surfaces which had previously been painted with unacceptable materials.

END OF SECTION

DIVISION 10

SPECIALTIES

SECTION 10440
SIGNAGE

SECTION 10440
SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

.1 This Section specifies signs to be located throughout the facility.

1.2 RELATED WORK

.1 Comply with Division 1 – General Requirements and all other Specification Divisions.

1.3 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American National Standards Institute (ANSI):

.2 ANSI/ICC A117.1, Standard for Accessible and Usable Buildings and Facilities

.3 ANSI Z535.2 American National Standard for Environmental and Facility Safety Signs

.2 American Society for Testing and Materials (ASTM):

.1 ASTM D4956, Standard Specification for Retro-reflective Sheeting for Traffic Control

.3 Occupational Health and Safety Act

1.4 DESIGN REQUIREMENTS

.1 Signage large enough to be read for the intended function or purpose.

.1 For text size, follow ANSI/ICC A117.1.

.2 Recessed colour contrasting lettering on inorganic material

.3 Sign Types: Sign types are to be as follows:

Sign Type	Description	Sign Style	Sign Text/Graphics
1	Room Name	Sign Style 2	<Room Name, eg. Mechanical Room>

5	Occupant Load	Sign Style 2	Maximum Occupant Load – 2 Persons

.4 Sign supports are to be capable of withstanding summation of the following loads:

.1 Expected wind load in any direction.

.2 Dead load of sign, supports and appurtenances.

1.5 SUBMITTALS

.1 Submit construction details, material descriptions, dimensions of individual component and profiles, and finishes for each sign type

.2 Submit Shop drawings indicating fabrication and installation details for signs and the following:

.1 Completed Sign Schedule

.2 Show sign mounting heights.

.3 Provide message list, typestyles, graphic elements and layout for each sign.

PART 2 PRODUCTS

2.1 SIGN STYLE 2 - PLASTIC SIGNS

.1 Interior/exterior signage with contrasting lettering.

.1 UV resistant.

.2 Minimum 3mm thick.

.3 Raised/recessed text.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install signage in accordance with manufacturer's instructions, exact locations to be determined on site.

.2 Install signage square, plumb and level.

.3 Install all signage in accordance with applicable local regulations and/or codes.

3.2 SIGN SCHEDULE

.1 Provide signs as needed and in accordance with the table below.

.1 Sign Type 1 Room Name: Install room name signage on all doors:

.2 Sign Type 2 Occupant Load: Unless noted otherwise, install one (1) occupant load sign on the main door of the building.

END OF SECTION

SECTION 10800
TOILET ACCESSORIES

SECTION 10800
TOILET ACCESSORIES

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 01300 – Submittals

1.2 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

.1 American Society for Testing and Materials ASTM International (ASTM)

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

.2 ASTM B456, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

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

.2 Canadian Standards Association (CSA)

.1 CAN/CSA B651-12, Accessible Design for the Built Environment.

.3 Ontario Building Code (OBC)

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit Shop Drawings and/or product data sheets in accordance with Section 01300 - Submittals.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough in frame, building in details of anchors.

.2 Closeout Submittals:

.1 Provide maintenance data for all components.

1.4 EXTRA MATERIALS

.1 Provide special tools required for accessing, assembly/disassembly or removal for all components.

.2 Deliver special tools to the Town.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M-15 with ZF075 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A167, Type 304, with #4 satin finish.

.3 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by the accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 Toilet tissue dispenser:

.1 Double roll toilet tissue dispenser with shelf, surface mounted, 22 gauge stainless steel #4 finish, with uncontrolled delivery mechanism.

.1 Manufacturer (basis-of-design): Bobrick.

.2 Model #: B-2840.

.3 Finish: Satin Stainless Steel

.4 Quantity: one

.2 Combination towel dispenser/waste receptacle:

.1 Recessed Paper Towel Dispenser / Waste Receptacle. Suitable for dispensing folded or roll paper towels. Removable waste receptacle, lockable access door with continuous full height stainless steel hinge.

.1 Manufacturer (basis-of-design): Bobrick.

.2 Model #: B-43944

.3 Finish: Satin Stainless Steel

.4 Quantity: one

.3 Soap dispenser:

.1 Surface mounted soap dispenser

.1 Manufacturer (basis-of-design): Bobrick.

.2 Model #: B-2111

.3 Finish: Satin Stainless Steel

.4 Quantity: one

.4 Sanitary napkin disposal bin:

.1 Surface mounted unit with lid, 22 gauge stainless steel finish.

.1 Manufacturer (basis-of-design): Bobrick.

.2 Model #: B-270

.3 Finish: Satin Stainless Steel

.4 Quantity: one

.5 Mirror:

.1 Wall mounted unit, fixed tilt mirror with vandal resistance concealed mounting and standard float glass. Size: 610 mm x 914 mm.

.1 Manufacturer (basis-of-design): Bobrick.

.2 Model #: B-293

.3 Finish: Clear with Satin Stainless Steel Edge

.4 Quantity: one

.6 Coat Hooks:

.1 12 gauge stainless steel finish.

.1 Manufacturer (basis-of-design): Bobrick.

.2 Model #: B-233

.3 Finish: Satin Stainless Steel

.4 Quantity: one

.7 Grab Bars (Water Closet)

.1 Stainless steel grab bars with integral tactile grip finish.

.1 Manufacturer: Bobrick

.2 Model #: B-6806

.3 Finish: Satin Stainless Steel (with slip-resistant surface)

.4 Quantity: one 610mm one 760mm

.8 Toilet – floor mounted

.1 4.8L/flush two piece Elongated toilet.

.1 Manufacturer: Kohler

.2 Model #: K-3999-0

.3 Finish: white vitrified porcelain

.4 Quantity: one

.9 Lavatory

.1 Mezzo Semi-countertop Sink with Center hole only.

.1 Manufacturer: American Standard

.2 Model #: 9960001.020

.3 Finish: white

.4 Quantity: one

.2 Faucet – Optima Hardwired-Powered Deck-Mounted Mid Body

.1 Manufacturer: Sloan

.2 Model #: EAF-200

.3 Finish: Stainless Steel

.4 Quantity: one

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install and secure accessories level, plumb and rigidly in place using concealed fasteners supplied by accessory manufacturer and in accordance with their recommendations.

.2 Install accessories in locations and heights indicated on Drawings on compliance with the requirements of the Ontario Building Code.

.1 Where not indicated install as requested by Consultant.

.3 Use tamper proof screws/bolts for fasteners.

.4 Insulate accessory surfaces to prevent electrolysis due to contact with masonry, concrete or dissimilar metal surfaces by approved means.

.5 Fill units with necessary supplies shortly before final acceptance of building.

.6 On completion of work, or when directed, remove all traces of protective paper coatings. Test mechanisms, hinges, locks and latched and adjust and lubricate where necessary to leave in perfect order. Make good all damage to satisfaction of the Engineer.

END OF SECTION

SECTION 10900
LOW PROFILE CONCRETE DECK TRUCK SCALE

SECTION 10900
LOW PROFILE CONCRETE DECK TRUCK SCALE

The following set of specifications shall describe a fully electronic, low profile, modular-type concrete deck truck scale system, designed to be mounted on a pier foundation system. Scale shall be a 4-module, 5-section system that is designed for field pouring of concrete.

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Comply with Division 1 – General Requirements and all other Specification Divisions, including:

.1 Section 01300 – Submittals

1.2 REFERENCES

.1 Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

.1 National Institute of Standards and Technology (NIST)

.1 Handbook 44

.2 The Society for Protective Coatings (SSPC)

.1 Joint Surface Preparation Standard (SSPC-A-SP6)

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Submit Shop Drawings and/or product data sheets in accordance with Section 01300 - Submittals.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware, description of rough in frame, building in details of anchors.

.2 Closeout Submittals:

.1 Provide maintenance data for all components.

PART 2 PRODUCTS

2.1 TRUCK SCALE

.1 The scale shall be a fully electronic, low profile, concrete deck design truck scale.

.2 The scale platform shall be designed and manufactured in the United States of America.

.3 The scale platform, load cells and digital indicators shall be assembled in the United States of America.

.4 The scale shall be a Rice Lake Weighing Systems Model 8011-SC-100-OTR or equivalent, that shall meet the following minimum standards:

.1 The scale shall have a full-scale capacity of 100 tons (200,000 lb) with a displayed resolution of 200,000 lb x 20 lb in accordance with NIST, Class IIIL devices.

.2 Scale shall be a fully electronic design. The scale weighbridge shall consist of factory-welded modules having a total longitudinal span of 80 ft (79 ft 10.5 in) and a platform width of 11 ft(10 ft 10.5 in). No field assembly or welding shall be allowed. Mechanical lever systems are not acceptable.

.3 Each scale module shall be designed with a Concentrated Load Capacity (CLC) of 50 tons (100,000 lb), as defined by NIST. When the CLC is applied at midspan on a module, according to NIST regulations, the maximum stress of the steel shall not exceed 17,500 PSI as determined by Finite Element Analysis (FEA) software. The deflection at this loading condition shall not cause the scale to exceed the allowable accuracy tolerance as specified by NIST in Handbook 44.

.4 The scale provided shall have an unobstructed weighing surface of 11 ft (10 ft 10.5 in) wide by 80 ft (39 ft 10.5 in) in length and an 18.75 in minimum profile. A minimum clearance of 4.25 in shall be provided between the concrete floor and the bottom of the weighbridge.

.5 The scale modules shall be designed as such to eliminate the use of grout plates requiring setting and leveling prior to the arrival of the scale at the job site. A maximum of two drilled anchors (3/4 in x 7 in) shall be provided with each load cell stand.

.6 The scale system shall be a fully electronic design, with an internal self-checking weigh-bridge. Weighbridges using bumper bolts, externally fixed check rods, or embedded bumper plates in the end walls shall not be permitted.

.7 Minimum weighbridge thickness shall be 12 in including steel support structure. A minimum of 6in clearance shall be provided between the bottom of the weighbridge and the washout slab.

.8 The entire length and width of the concrete deck shall be supported by an intricate steel support structure. Only structural wide flange beam construction shall be allowed. Weighbridge designs utilizing junior beams and/or bent plate shall not be permitted.

.9 Concrete deck shall be field poured at the job site and have a maximum cured strength of 4000 PSI at 28 days. Concrete deck shall have a minimum thickness of 6 in with one mat of #4 reinforcing rod on 12 in centers. Concrete decks utilizing fiber mesh additives to concrete shall not be allowed. Pre-poured, pre-cast, or pre-stressed, concrete decks shall not be permitted.

.10 Internal steel support structure for concrete shall consist of a minimum (2) 12 in the wide flange, 14 pounds per foot, main beams and (7) 6 in wide flange, 9 pounds per foot, beams and a 3/16 in bottom plate.

.11 Shear-cut galvanized strips shall be attached to the support beams and serve as a forming pan for the concrete deck. Plates shall be installed in a manner to minimize penetration of concrete below the support pan. Module shall arrive at the jobsite ready for field pouring of concrete with no shoring of deck required.

.12 The entire bridge assembly shall be cleaned prior to the addition of any coatings or paint to the weighbridge modules. Customer reserves the right to inspect the steel surfaces prior to application of any coatings to the prepared steel surfaces. All steel surfaces shall be free of all welding gases, residue, oil, mill scale and rust.

.13 All non-visible steel surfaces shall be evenly spray coated with an asphalt emulsified coating or have equal protection applied.

.14 All steel elements shall be steel shot blasted to SSPC-A-SP6 standards.

.15 All visible steel surfaces shall receive a 3-5 mill application of a high solids urethane primer and a high solids acrylic urethane top coat to a finish of 2-3 mill thickness.

.16 ¾ in x 4 – 3/16 in Nelson shear studs shall be provided in the module both vertically and laterally.

.17 Concrete elements in the weighbridge shall be utilized in a compression application above the neutral axis of the structure. Weighbridge designs allowing the concrete to extend below the neutral axis subjecting the entire concrete deck to tension or bending forces shall not be permitted.

.18 Module end plates shall be a minimum 3/4" thick and shall be reinforced on each side with longitudinal I-beams. Load cell pockets shall be integrated into the module structure and constructed of 3/4 in steel plate and shall be tied to the end plates using tabs and laser cutouts to reinforce strength of the assembly. Scale modules using flat welded or bolted end boxes shall not be allowed.

.19 Structural steel elements shall have a combined minimum weight of 25,400 lb.

.20 The scale shall be NTEP Certified and shall meet the requirements set forth by the NIST Handbook 44 for Class III-L devices. The bidder shall submit a current copy of the Certificate of Conformance with the bid.

.21 Access covers to the load cells shall be from the top of the scale and shall be boltless in design. Cover plates shall be reinforced to adequately handle axle traffic over the covers and shall be kept in place with 1/2 in diameter x 1 in long steel dowels. Cover plates utilizing bolts of any type shall not be permitted.

.22 Scale shall be equipped with optional gusseted bolt-on safety guiderails on each side of the scale with a minimum of 4 in diameter pipe. A minimum of three bolts shall be used at each gusset to attach side rail. Guiderails welded to weighbridge shall not be permitted.

.23 The scale provided shall be a Rice Lake Weighing Systems SURVIVOR® Series Model 8011-SC-100-OTR or equivalent.

2.2 LOAD CELLS AND JUNCTION BOXES

.1 Load cells are rigidly mounted utilizing a single link suspension to provide equal and consistent and evenly distributed force to the load cell.

.2 Load cells are totally self-contained, and come complete with mounting stands, single-link suspension, and 60 ft of cable to the junction box.

.3 Compression or rocker-style load cells shall not be permitted.

.1 Load Cells shall be rigidly mounted in fabricated steel stands parallel to traffic flow. The suspension system will be E4340 material forged single link suspension hardened to Rockwell “C” 40-45 to allow self-centering and free-floating platform. Rocker column or compression-type load cells requiring check rods, anti-rotation pins or bumper bolts will not be permitted.

.2 Load cells will be of the analog type and have a minimum capacity of 75,000 lb each with an overload safety factor of 150 percent. Scales utilizing a lower capacity load cell than 75,000 lb will not be permitted.

.3 Scales utilizing adjustable bumper bolts or embedded plates in the wall to minimize movement of the bridge shall not be allowed.

.4 Systems utilizing proprietary, internal circuitry to convert analog to digital conversion of the load cell signal within the load cell shall not be permitted.

.5 All access to load cells will be from the top of the scale through formed boltless steel access panels. Covers should be form fitted and should be accessible without use of tools.

.6 Steel conduit will be provided within the weighbridge for load cell cable runs.

.7 A flexible screw-type conduit fitting shall be provided at each load cell. Load cell cable shall be totally enclosed within permanent conduit provided within the weighbridge. Load cells using connectors of any type will not be permitted. Braided metal cable covering shall not be used in place of steel flex conduit or hardened steel conduit.

.8 Load cells shall be of 4340 alloy steel nickel plated and shall be sealed with a minimum IP67 rating.

.9 Load cells shall be non-proprietary in design, including both mechanical operation and electronic transmission of data. Manufacturers using proprietary load cell technology available from a single source will not be permitted.

.10 Replacement load cells shall be available from a multitude of vendors nationally, and shall not be single sourced or of a proprietary design.

.11 Fiberglass Reinforced Polyester (FRP) junction box with formed contoured edges and gasketed top access. Junction box shall have a GORE-TEX® single directional membrane vent. Steel junction boxes shall not be permitted.

.12 Load cell stands will be flush mounted to concrete piers and anchored using wedge locks or similar bolts. A maximum of (2) ¾ in x 7 in anchor bolts will be required per stand and will be included in the cost of the scale. Grout plates or embedded items in the foundation concrete will not be allowed.

.13 A 1 in braided copper transient bypass cable shall be provided at each load cell from the weighbridge to the base stand.

.14 UPS Duplex Voltage regulating transformer, or equivalent.

.15 UJB-3T6 DC Transient circuitry protection or equivalent.

.16 The weighbridge, load cells, junction box, digital weight indicator and remote display shall be warranted for a minimum of full twelve years against failure of all types including lightning or surge voltage.

.17 A single-point grounding system will be provided. Systems utilizing a multiple point ground will not be permitted.

2.3 DIGITAL INSTRUMENTATION SPECIFICATIONS

.1 The scale instrument shall be a Rice Lake Weighing Systems 1280 Enterprise™ Series programmable indicator/controller complete with operator-friendly diagnostics for load cells
and digital j-box or equivalent.

.2 The scale instrument shall be NTEP Certified and meet or exceed all specifications set forth by NIST Handbook 44 for Class II, III, and IIIL devices. Additionally, the instrument shall meet or exceed approvals for UL, C-UL and CE. The manufacturer, on request, shall provide a Certificate of Conformance (COC) to these standards.

.1 The scale instrument shall be housed in an all stainless steel 304, IP69K enclosure measuring 10.85" wide x 12.50" high x 5.25" deep.

.2 The instrument shall be 100 percent manufactured by the manufacturer of the weighbridge assembly.

.3 The instrument shall be Linux® based

.4 The scale instrument shall be fully programmable and configurable according to the needs of the application.

.5 The scale display shall be a LCD graphical, color display with minimum size of 800 x 480 pixels and be available in 500 or 1,000 NIT.

.6 The instrument shall allow the connection of a QWERTY-type, computer-style keyboard.

.7 The front panel of the instrument shall have the following operational keys as standard with tactile feedback:

.1 Zero

.2 Print

.3 Gross/Net

.4 Clear

.5 Tare

.6 Decimal Point

.7 Units

.8 Numeric 0-9

.8 The instrument shall have the following displayed operational annunciators: gross, tare, net, zero, motion and three units of measurement.

.9 The scale instrument shall have the capability of powering up to (16) 350 Ohm load cells.

.10 The instrument shall have the ability to display both gross and net weights and the ability to recall gross or tare weights in the net mode.

.11 The instrument shall have the ability to provide in/out, gross/tare/net calculation of individual truck weights and storage for the following information:

.1 1,000 open transactions

.2 1,000 tare weights

.3 Database report

.12 The instrument shall have six smart card slots for additional scale channels, serial ports, digital inputs and outputs, analog outputs and protocol interfaces.

.13 The instrument should have 100 setpoints, 18 configurable setpoint types.

.14 The scale instrument shall be designed to provide noise protection for RFI, EMI and ESD.

.15 The excitation voltage shall be 10 +/- 0.5 VDC.

.16 The instrument shall have an automatic zero tracking feature that will be programmable and in compliance with NIST, Measurement Canada and OIML regulations.

.17 The instrument shall be fully programmable.

.18 The instrument shall include as standard surge voltage protection as recommended by the manufacturer.

.19 The digital instrument shall be warranted by the manufacturer for two years from date of installation.

.20 The instrument shall have a multi-level digital filtering system for environmental noise or vibration.

.21 Individual load cell monitoring, and system diagnostics shall be available when paired with the iQUBE2® digital diagnostic junction box.

.22 The scale instrument shall have an internal resolution of 8.000.000 counts.

.23 Operating temperature for the instrument shall be -4F to 131F (-20C to 55C).

.24 Customized programmable print formats, including 20 auxiliary print formats, shall be available.

.25 Operational power input shall be 115 or 230 VAC, ±10 percent. 50/60 Hz single phase.

.26 The scale instrument shall have the capability of receiving custom programs.

.27 The instrument shall have a real-time clock and battery-backed feature.

.28 A/D conversion rate shall be selectable from 7.5 Hz to 960 Hz.

.29 Multi-range/internal selection for setting two or three weight ranges with different division sizes.

.30 The digital instrument should have web server capabilities.

PART 3 EXECUTION

3.1 GENERAL

.1 The Contractor shall fully coordinate the delivery, installation, and testing of all equipment.

3.2 INSTALLATION

.1 Prepare the site prior to pouring the concrete foundations as per the IFC drawings and Division 02 – Site Works.

.2 Pour the concrete foundations as per the IFC drawings and Division 03 – Concrete.

.3 Lay out cables for power, communication, and load cells, following manufacturer's instructions.

.4 Before installing the load cells, position the baseplates.

.5 Set specialized locating blocks where the load cells will be placed. These blocks will help align the baseplates with the scale deck.

.6 Once the baseplates are in position, lower the modules into place. Employ a skilled boom operator to maneuver each scale module into place.

.7 As the operator lowers each module, specialized technicians shall adjust the baseplates and locating blocks to align them perfectly with the scale modules.

.8 Once the scale is in place and aligned to create a seamless weighing surface, the technicians shall anchor the baseplates to the foundations.

.9 After the installation of the load cells, complete cell wiring to ensure the electrical connections are established for power supply and data transmission.

.10 Set up peripheral devices as per manufacturer instructions.

.11 Calibrate the scale upon completion of the scale installation using known weights for accuracy.

.12 Address discrepancies through calibration adjustments and confirm reliable and consistent functionality.

.13 Comply with legal regulations and standards.

.14 Inspections shall be conducted to ensure adherence to weight measurement regulations.

.15 Calibration certifications shall be provided to validate accuracy.

.16 Train staff on scale operation, interpretation of readings, and basic troubleshooting.

.17 Provide clear documentation and manuals for reference.

3.3 ON-SITE INSTALLATION AND INSPECTION

.1 The Contractor shall ensure that the manufacturer's representative(s) will attend the Site to inspect, operate, test, adjust, and trouble shoot the installation as required until the completion of testing and commissioning.

.2 Refer to Section 01820 – Demonstration and Training.

.3 operation. Obtain the Consultant's approval of the report form prior to use.

.4 The inspection shall include:

.1 Verification of the soundness of the system (that it is without any cracked or otherwise damaged parts).

.2 Completeness of installation as specified in the Contract Documents and as recommended by the manufacturer.

.3 Correctness of setting, alignment, and relative arrangement of various parts of the system.

.5 Operating, testing, and adjusting will serve to prove that the equipment is satisfactorily installed to operate under the intended conditions as specified in the Contract Documents.

.6 Equipment will not be accepted by the Consultant without the manufacturer representative's report.

.7 Modify or replace any equipment or materials which fail the required tests.

.8 Perform any additional testing which may be required as a result of any changes to materials due to the failure of materials or construction to meet the requirements of the Specifications at no extra cost to the Region.

.9 Submit the manufacturer's representative's signed report describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to the requirements set out in this Specification.

.10 Test and commission the equipment in accordance with Section 01810 – Equipment Testing and Facility Commissioning.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15000
SCOPE OF MECHANICAL WORK

SECTION 15000
SCOPE OF MECHANICAL WORK

PART 1 GENERAL

1.1 INTENT

.1 The Contractor shall furnish, install and commission all equipment, labour, materials, tools, and provide all necessary supervision and other services as required to execute the work and to realize the intent of the project.

.2 The supply and installation of mechanical items must be in accordance with the Specifications and Drawings of this contract.

.3 The Specifications and Drawings and Addenda constitute the full scope of the project. All items required but not shown on the Drawings or not mentioned in the Specifications that are necessary for a complete mechanical installation shall be regarded as included in the project requirements.

.4 The Contractor shall furnish all equipment and accessories specified herein including all other accessories and details not specifically mentioned or fully detailed, but which are reasonably required to make a complete and well-integrated product within the scope of this Specification.

1.2 SCOPE OF WORK

.1 The sites must be maintained in a dry, clean and secure state. The Contractor is responsible for coordinating the supply of temporary power, water, heat, ventilation, compressed air, etc., provision of all necessary materials to safely power the equipment, and relocation of such supply as required throughout the construction period.

.2 Contractor is to take direction from the Engineer.

.3 Major components required to complete this project include the items detailed in Contract Drawings, Division 15 and the following:

.1 Supply and installation of:

.1 Remove all indicated equipment, materials and systems and legally dispose of site and abide to all applicable Bylaws and Codes**.**

.2 As indicated in the drawing schedules, supply, deliver, unload, store, install, program, test, demonstrate, commission and certify ALL new equipment and materials (applies to each pumping station):

.3 Thermal insulation for all indoor-located air supply plenums and ducts (entire length and full surface) conveying not heated outdoor fresh air. Thermal insulation for air conditioner tubing.

.4 Thermal insulation for all indoor located potable and non-potable water supply pipes, valves and accessories.

.2 Supply and installation of miscellaneous works and materials to install mechanical equipment as specified in drawings and engineering specifications.

.3 Supply and installation of electrical work and controls for mechanical system operation in accordance with Divisions 13 and 16.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 15010
BASIC MECHANICAL REQUIREMENTS

SECTION 15010
BASIC MECHANICAL REQUIREMENTS

SECTION 15010
BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

.1 Comply with Division 1 – General Requirements. These general instructions are intended to supplement and not replace the requirements of the Division 1 – General Requirements.

.2 The requirements of this section apply to Division 15 – Mechanical.

.3 The specification is divided into divisions of work and a division may consist of the work of more than one subcontractor. The responsibility as to which subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Contractor.

.4 Section Includes

.1 Basic requirements for the supply, installation and testing of mechanical equipment and piping systems in Division 15 including ductwork and water systems and is supplemented by other specific details shown or specified in the respective system Sections.

1.2 REFERENCES

.1 Work in this Division includes:

.1 HVAC

1.3 SCOPE

.1 Provide all labour, materials, equipment and services to complete the work specified and shown on the drawings.

.2 The work specified herein includes plumbing, building drainage, piping, heating/cooling and ventilating systems in buildings and chambers.

.3 Provide all accessories and appurtenances as required to ensure complete and operational systems.

.4 The plans and specifications and any addenda are intended to set the acceptable minimum and shall not be construed to relieve this Contractor of the responsibility of:

.1 Installing complete and trouble-free systems.

.2 Good workmanship acceptable for approval by the Owner and its designated operators for the completed system.

1.4 CODES, REGULATORY ACT STANDARDS

.1 The work shall conform strictly with all rules, regulations, by-laws and the requirements and interpretations of all authorities having jurisdiction.

.2 Do not reduce the standard established in the Contract Drawings and specifications. Drawings, standards and specifications with most stringent requirements shall apply for all aspects of this project.

.3 Upon the request of the Consultant, the Contractor's suppliers are required to provide proof of compliance with all applicable codes and standards. If requested, provide standard section and conformance clause.

.4 Conform to the following codes, regulations and standards including the latest revisions issued up to date of tender submission.

.1 Ontario Occupational Health and Safety Act

.2 The latest application regulation of the Ontario Building Code

.3 The Ontario Water Resources Act, Ontario Regulation 736 as amended to O. Reg. 567/81 (Plumbing and Drainage Systems)

.4 ASPE Data Book

.5 ASHRAE Guide and Data Books

.6 SMACNA "HVAC Duct Construction Standards – Metal and Flexible" "Thermoset FRP Duct Construction Manual"

.5 All other codes, standards, regulations referred to in the above documents, adopted by the authorities having jurisdiction and/or applicable to the work of this Division as shown on the Contract Documents.

1.5 SYSTEM DESCRIPTION

.1 Supply the equipment complete in all respects including all other accessories and auxiliaries necessary to provide for a satisfactory installation.

.2 All external piping and electrical connections to this equipment, and all concreting and foundation bases (excluding grouting and shimming) will be done under the respective sections for such work.

.3 Check dimensions associated with existing structures, equipment and piping in the field before the Work commences.

1.6 MAINTENANCE DATA

.1 Refer to Sections 01780 - Closeout Submittals; 01430 - Operation and Maintenance Manuals.

.2 Operation data to include:

.1 Control schematics for each system and its components including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description and sequence of actions to be taken in event of equipment malfunction and/or failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Recommended spare parts list, including supplier name, address, telephone and contact name.

.3 Data to include schedules of tasks, frequency, tools and materials required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified elsewhere.

.4 Testing, adjusting and balancing reports.

.5 Additional data:

.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.7 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01300 – Submittals.

.2 Shop Drawings shall include:

.1 Piping systems require plans and sectional views, or single line dimensioned isometrics, identifying movements due to thermal expansion and contraction. Locations of the expansion pieces, guides, and anchors, sway braces shall be identified. The resultant movements due to these thermal expansions and contractions shall be shown on shop drawings.

.2 Provide details of expansion pieces including list of materials.

.3 Valve schedule and identification list.

.4 Sectional details of drains, traps, valves and valve operators including list of materials and current ANSI pressure and temperature ratings for valve bodies, seats and stem seals.

.5 Ductwork materials, sheet thickness and reinforcement

.6 Provide general layout of equipment including anchor bolt locations, direction of rotation for rotating equipment and electric motor terminal box location.

.7 Cross-sectional details of equipment with complete materials test.

.3 Shop drawings and product data shall show:

.1 Equipment and material

.2 Operating voltage and rating

.3 Dimensions

.4 Blade, linkage, and damper motor arrangements

.5 Performance curves

.6 Mounting arrangements

.7 Operating and maintenance clearances, e.g., access door swing spaces

.4 Provide fabrication and installation details including anchorage, accessories and finishes.

.5 Provide shop drawings for the following:

.1 Fans

.2 Heating Equipment

.3 Metallic Ductwork

.4 Ductwork

.5 Duct Accessories, bird and insect screens

.6 Grilles, Registers and/or Diffusers

.7 Fire Stopping Material with cUL Listed Installation Details

.8 Control Devices

.9 Duct and piping insulation

.10 Plumbing specialties and accessories

.6 Shop drawings and product data shall be 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 as to current model production.

.5 Certification of compliance to applicable codes.

.6 Electrical schematics and wiring diagrams for all equipment.

.7 Test Reports and Certificates

.1 Manufacturer’s representative signed report.

.2 Field test reports for piping systems.

.3 Manual shall include installation, operation and maintenance instructions for equipment, valves and appurtenances.

.4 Refer to Division 1 individual equipment specification in Division 11, regarding requirements for submission of working drawings, equipment manuals, etc.

.8 Submittals to Owner's Consultant shall be for compliance purposes only.

.9 Do NOT order equipment until shop drawings have been reviewed by the Consulting Consultant.

1.8 DRAWINGS

.1 The drawings show approximate location of equipment in diagrammatic form. Obtain any information involving accurate dimensioning in relation to structure, fixture locations, etc. on the site.

.2 Equipment dimensioning to be obtained from reviewed shop drawings.

.3 Make, without additional charge to the Owner, any necessary change to ductwork to accommodate structural conditions and headroom. Obtain the Consultant's approval prior to making any changes required due to conflict of trades.

1.9 AS-BUILT DRAWINGS

.1 Refer to Section 01780 - Closeout Submittals.

.2 Site records:

.1 The Consultant shall provide the Contractor with one set of reproducible, mechanical, electrical and instrumentation and structural drawings at the commencement of site construction activities. Provide sets of white prints, as required, for each phase of the work. Mark thereon all changes as work progresses and as changes occur including Change Orders.

.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Drawings shall show all inverts and sizes of all pipes, buried pipes and ductwork, and exact routing of the pipes and ductwork.

.5 Make available for reference purposes and inspection at all times.

.3 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), 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 Contractor) (date).

.3 Submit to the Owner's Consultant for compliance purposes and make corrections as directed.

.4 TAB to be performed using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.4 Include copies of as-built drawings in the final TAB report.

1.10 PERMITS, FEES AND INSPECTIONS

.1 Execute all work in accordance with all applicable rules, by-laws and regulations. Give all necessary notices, obtain all necessary permits, pay all required fees and furnish any certificates necessary as evidence that the work conforms with the rules and regulations of all authorities having jurisdiction.

.2 Carry out all changes and alterations required by an authorized inspector of any authority having jurisdiction. Advise the Owner's Consultant of any such changes.

.3 Pay for all fees related to TSSA permits, variance applications, commissioning and inspections. Refer to drawings for notes regarding TSSA coordination items.

1.11 MATERIALS HANDLING AND STORAGE

.1 Provide all necessary equipment materials and labour to off-load equipment at the Site and provide for any additional transportation necessary for storage or installation on Site. The methods employed for off-loading and handling must be to the satisfaction of the equipment supplier and the Contract Administrator.

.2 Before taking delivery examine the equipment for any damage. Rectify any damage to the equipment. Ensure that the equipment supplier first approves any repairs required, such that guarantees are not invalidated.

.3 If not required for immediate use, adequately store and protect all equipment against weather, damage and theft. Take particular care with corrodible electrical equipment. Store mechanical equipment in an area heated to a minimum of 10°C. If extended storage time is required, perform periodic maintenance in accordance with the manufacturers' instructions.

.4 Immediately upon delivery or unpacking, turn over all spare parts, in working condition, to the authority having jurisdiction.

1.12 RELATION TO OTHER TRADES

.1 Co-ordinate works with all other Trades involved in the execution of the Works. Arrange work so as not to interfere with or delay other sub-trades.

.2 Related work as specified elsewhere is as follows:

.1 Concrete: Division 3.

.2 Instrumentation and Controls: Division 13.

.3 Electrical: Division 16.

1.13 GUARANTEES

.1 Provide warranty and guarantees in accordance with the Section 5 – General Conditions Item 7.15 and Section 5A- Specific Conditions of Contract Item 27.

.2 Guarantee against failure due to faulty design, workmanship, materials, or failure to achieve specified operating conditions, or other conditions implied from data provided by the Contract Administrator or noted during the review of Shop Drawings.

1.14 INSTALLATION AND COMMISSIONING

.1 Comply with Sections 01800 – Starting Systems and 01825 – Performance Testing.

.2 When the Contractor has completed his installation work and before any equipment is operated, the Contractor is to instruct the equipment or material Vendor to commission the equipment.

.3 Provide the services of a skilled representative at the site to carry out the following work:

.1 Check the installation as to its workmanship and completeness.

.2 Check the equipment operation.

.3 Perform running tests under load conditions to check power draw and ensure units operate smoothly and without excessive vibration.

.4 Instruct the plant personnel in the routine operation, preventive maintenance and breakdown repair of the equipment. Refer to Section 01830 – Training for details.

1.15 ACQUAINTANCE WITH WORK

.1 Be fully acquainted with all work involved in the complete installation of all equipment. At no time make any claim that any misunderstanding existed in regard to the nature or amount of work to be done.

.2 Obtain from Equipment Vendors' the details, dimensions and other information pertinent to the work of this Contract.

1.16 MATERIAL AND WORKMANSHIP

.1 Material and equipment to conform to the latest edition of applicable standards in force at the time of tendering. In the case of conflict of these specifications with any standards, the more stringent of the two applies.

.2 Provide Materials and Equipment:

.1 First class in every respect. All materials shall be new and not refurbished.

.2 Constructed and finished in a workmanlike manner.

.3 Suitable for the service intended.

.4 Selected and fabricated to best Consulting practice.

.3 Furnish safety devices including shear pins, flexible coupling guards, belt guards and other pertinent items with the equipment.

.4 Carefully pack and crate equipment for shipment. Protect polished and machined metal surfaces from corrosion and damage during shipment. Specially pack electrical equipment to prevent damage by moisture. Cover equipment having exposed bearings and glands to exclude foreign matter.

1.17 QUALITY ASSURANCE

.1 Testing

.1 Comply with Section 01825 – Performance Testing.

.2 Insulate and/or conceal work only after testing is satisfactorily completed.

.3 Conduct all tests in the presence of the Contract Administrator.

.4 Bear all costs of testing including retesting and making good.

.5 Maintain test pressures for at least 4 hours unless otherwise specified.

.6 Test equipment as specified in the relevant sections and as a minimum, demonstrate that each piece of equipment operates as specified.

.2 Standards

.1 ANSI B32.1 Metal Products

.2 CSA CAN3S16.1M Steel Structures for Buildings (Limit State Design

.3 CSA S244 Welded Aluminum Design and workmanship (Inert Gas Shielded Arch Processes)

.4 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures

.5 CSA W47.22M Certification of Companies for Fusion Welding of Aluminum

.3 Certificates

.1 Shop Finished Metal

.1 Certify that the shop finished metal components received the specified protective coating system.

.2 Welding Aluminum

.1 Certify that the companies which will be welding aluminum items are CSA-approved.

1.18 TAGGING INSTRUCTIONS

.1 For equipment to be replaced, existing equipment tags are to be removed, protected and reused with new equipment or replaced. If an equipment tag is missing, damaged or does not meet current City of Toronto tagging standards, a new tag is to be supplied by the Contractor in accordance with the Equipment Tagging Specification found in Division 13.

PART 2 PRODUCTS

2.1 STANDARDS OF MATERIALS

.1 Materials and equipment are specifically described and named in this Specification in order to establish a standard of material and workmanship.

.2 Materials required for performance of work shall be new and the best of their respective kinds and of uniform pattern throughout work.

.3 Equipment items shall be standard products of approved manufacture. Identical units of equipment shall be of same manufacture. Any unit of equipment, specified herein, shall be in accordance with latest issue of applicable Standards

or Authorities when such are either mentioned herein, or have jurisdiction over such materials or items of equipment.

.4 Materials shall bear approval labels as required by Code and/or Inspection Authorities.

.5 Install materials in strict accordance with manufacturer's recommendations.

.6 Include items of material and equipment not specifically noted on drawings or mentioned in Specifications but which are necessary to make a complete and operating installation.

.7 Confirm capacity or ratings of equipment being provided, when based on ratings of equipment being provided under other trade Sections, before such items are purchased.

.8 Remove materials, condemned as not approved for use, from job site and deliver and install suitable approved materials in their place.

2.2 EQUIPMENT

.1 Use only new and best quality materials and equipment. Install and rig all equipment in workmanlike manner.

.2 Deliver equipment to site painted with one heavy coat of rust resisting primer or prefinished with standard factory applied baked enamel finish unless otherwise specified. See equipment specifications and schedules for specific coatings.

2.3 MATERIALS

.1 All materials, fixtures, fittings, appliances and apparatus supplied and installed by the Contractor shall be new, of recognized manufacture, and the best of their kind suited to the application, and free from all defects.

.2 Include in the work all jointing, couplings, fittings, gaskets, insulation, wrapping, flanges, bolts and nuts, wall pieces, blocking, all pipe supports (including steel pipe racks), and all other material necessary to properly install the pipe. Include all other items necessary for the proper functioning of the equipment or reasonably inferable from the Drawings, whether indicated on the Drawings or specified herein, or not.

2.4 BASES, SUPPORTS

.1 This Contractor shall supply and install all iron and steel structures as may be required for the installation of equipment supplied by the Contractor, including any curbs, forms and flashing required for equipment and work located on and/or passing through the finished roof.

.2 Concrete and masonry work and lintels, related to mechanical work will be done by General Trade. Mechanical contractor shall coordinate with General contractor for location and size.

2.5 ELECTRICAL

.1 Unless otherwise noted, all starters, all power and line voltage (over 24 V) control wiring shall be done under Division 16; however, it is the responsibility of the Prime Contractor to confirm work covered by each sub-trade.

.2 All motors required for equipment supplied by this division shall be supplied and installed by this Contractor except as noted above.

.3 Supply a list of all motors with electrical characteristics to the Electrical Contractor.

2.6 ELECTRIC MOTORS AND AUXILIARY EQUIPMENT

.1 Fully coordinate all work to complete all mechanical and electrical work associated with electric motors and equipment.

.2 Refer to electrical specifications for starters, disconnect switches, etc., and electrical wiring to complete the power supply system to each motor or piece of equipment, unless specifically noted otherwise.

.3 For availability of electrical services, refer to electrical specifications.

.4 Use open drip-proof type motors unless specified otherwise for all motors up to 0.75 kW and TEFC over 0.75 kW complete with T-rated frames (NEMA specifications). Motor efficiency shall be compliant with the latest OBC and ASHRAE requirements.

.5 Extra low voltage means any voltage up to and including 30 volts. Low voltage means any voltage from 31 to 750 volts inclusive. High voltage means any voltage above 750 volts.

2.7 FLUSHING CONNECTIONS

.1 Provide flushing connections, as detailed, with Crane Fig. No. 428 gate valves, equipped with brass hose thread nipples having 40 mm straight iron pipe thread, at intervals of approximately 30 m on process sump discharge, sludge and other piping of ductile iron.

2.8 FINISHES

.1 Shop prime all ductile iron, cast iron and steel piping and fittings with one 0.05 mm thick coat of Glidden G-G 5205 Universal Primer or approved equal.

.2 Shop prime all pipe to be insulated with one 0.05 mm thick coat of Glidden G-G 5205 Universal Primer.

.3 Field painting over bituminous type or temporary black lacquer type coatings will not be allowed. Pipe must be sandblasted accordingly to SSPC-SP-6 and primed as above.

.4 Finish piping and mechanical equipment to the following quality:

.1 Welds free of slag, ground and buffed.

.2 Surfaces of castings ground smooth.

.3 Corners and edges on sheet metal work rounded.

.4 Stainless steel pipe free of steel wire rope marks.

.5 Materials, piping and equipment free of dents.

.6 Machined surfaces finished to specified tolerances.

2.9 BELT DRIVES, SHEAVES, AND GUARDS

.1 Provide belt driven equipment with V-belt drive, designed for at least 130% of motor nameplate power rating and in accordance with manufacturer's recommendations for type of service intended, ensuring belt drives are at least 95 percent efficient. Provide matched sets of belts for multiple belt assemblies. Select belts to suit starting torque of driver. Use single belt drives only for motors 1.5 kW and smaller. Provide one set of spare belts throughout for all equipment. All sets to matched type as above. Provide a complete list of belts and sizes etc. in the spare parts list.

.2 Provide motor sheaves for one and two belt drives of variable pitch type, with key adjustments. Supply two sets of fixed drive sheaves for drives with three or more belts. Install first set of fixed motor sheaves to obtain the originally specified rpm. After initial test and preliminary adjustment, install the second set of fixed sheaves if necessary, to provide design flow quantities as established on site. Obtain correct total air flow for fans through speed changes and not by throttling.

.3 Provide belt driven equipment with perforated guards with frame. Frame and guard to be 316 stainless steel or epoxy coated aluminum but must be rigid. Securely fasten to equipment. Provide guards to enclose drives and pulleys with access panel or opening opposite motor and drive shafts, easily removable for servicing and insertion of tachometer.

.4 Provide 18 gauge stainless steel sheet metal guards typical to above for couplings of direct driven equipment which have projecting parts.

.5 Sheaves

.1 Select variable and adjustable pitch sheaves unless otherwise specified.

.2 Provide motor driven equipment using 2 or more belts with fixed sheaves.

.3 Fit reinforced belts in sheave matched to drive. Multiple belts on unit to be matched set.

.4 Use cast iron or steel sheaves secured to shafts with removable keys.

.5 Standard adjustable pitch drive sheaves having + 10% range to be used on motors from 0.25 kW to 7.5 kW. Use mid-position of range for specified RPM.

.6 For drives larger than 7.5 kW, sheaves to be split tapered bushing and keyway having a fixed pitch, unless specifically required for item concerned. Provide sheave of correct size for balancing.

.6 Drive Rating

.1 Minimum drive rating to be 1.5 times nameplate rating of motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Adjustment

.1 Motor slide rail adjustment plates to allow for centerline adjustment.

.8 Guards

.1 Provide guards for exposed pump drives.

.2 Unless specified, guards for drives to have:

.1 Expanded metal screen welded to 25 mm steel angle frame.

.2 18 Ga. Stainless steel sheet metal tops and bottoms.

.3 Removable sides for servicing.

.4 40 mm diameter holes on both shaft centres for insertion of a tachometer.

.3 Secure guards to driven machine, foundations or floors with heavy angle supports and anchor bolts.

.4 Do not short circuit vibration isolators.

.5 Provide means to permit lubrication, use of speed counters, or other maintenance and testing operations, with the guard in place.

.6 Install belt guards to permit movement of motors for adjusting belt tension.

.7 For flexible couplings, provide removable “U” shaped guards fabricated from 12 Ga. stainless steel frame with 18 Ga. expanded mesh face.

.8 Provide protective screen on both inlet and outlet of exposed fan blades. Screen to be fabricated from 20 mm mesh minimum stainless expanded metal such that the net free area of openings is not less than 80% of the original opening.

.9 Provide oil gauges, grease cups, oil cups or grease gun fittings at all points requiring lubrication. Extend all fittings as required to be fully accessible without requiring any disassembly or removal of guards.

PART 3 EXECUTION

3.1 EXAMINATION OF SITE

.1 Visit and examine the site. No allowance will be made for any expense incurred due to failure to make this examination.

3.2 COORDINATION

.1 Coordinate the work of all trades installing equipment and services which may affect work and arrange equipment in proper relation with equipment installed under all Divisions of the specifications.

.2 Should the Contractor fail to correspond with requests or misdirect other trades, such corrections and/or additional work as directed by the Owner’s Consultant, shall be at this Contractor’s expense.

.3 Furnish items to be built-in, in time, with pertinent information, commensurate with the progress of the work.

.4 Coordinate provision of curbing and flashing for pipes, vents, ducts, etc., passing through roof and walls. Make provision for expansion and contraction and provide counter flashing.

.5 Coordinate concrete work for support of piping not laid on solid stable ground. Provide concrete bed, solid concrete block or concrete piers to satisfaction of local inspectors.

3.3 EXISTING SERVICES AND EQUIPMENT

.1 The Contractor shall be responsible for making all necessary connections to existing systems as indicated on the drawings. Coordinate with existing services regarding location and elevation, confirming locations prior to any excavating.

3.4 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT, VALVES, ETC.

.1 Provide suitable skids boxes or other framework to adequately protect equipment, valves, etc., during shipping and unloading.

.2 Arrange for delivery to Site of equipment, valves, etc., provided that construction of structures has advanced so far as to adequately protect units from weather and construction dust and debris. If units are delivered to Site prior to structure being suitably enclosed, provide weather tight heated storage enclosure at no additional cost to the Owner. Improperly stored equipment, valves, etc., will be cause for rejection.

.3 Provide equipment, valves, etc., and labour for unloading, moving and placing units into final position.

.4 Store motors shipped in a protected and heated area free from dust, moisture and other conditions that could damage motors.

3.5 INSTALLATION OF EQUIPMENT

.1 Coordinate exact location and placements of all equipment and items with subtrades. Interference drawings are the responsible of the Contractor.

.2 Coordinate opening locations and sizing with structural drawings. Where different or additional sizes or locations are required, prepare drawings for submission to the Consultant indicating all wall, floor and roof penetrations for ducts and piping with dimensions.

.3 Install, calibrate and test equipment in accordance with manufacturer’s written instructions and when specified, under supervision of competent experts provided by the equipment manufacturer. Provide calibration and test reports.

.4 Erect mechanical equipment on foundations complete with suitably sized anchor bolts and take special care to ensure true alignment of parts, especially pumps and electrical drives. Align the units after their sole plates have been shimmed at the anchor bolts. Recheck alignment after securing equipment to its foundation before grouting sole plates in place.

.5 Recheck alignment of equipment handling hot fluids, during initial operation.

.6 Erect equipment level and plumb. The use of “pipe springing” and “Dutchmen” to correct misalignment and misfitting is not allowed. In general, install mechanical

equipment directly on machined bases without shims; provide at least 1.5 mm of brass shim stock under driver mounting feet.

.7 Provide all materials necessary to install equipment. Install piping and miscellaneous items supplied as part of the equipment including lubrication piping, pressure gauge tubing, thermocouple sensors and wiring, bubbler tubing, orifice meter tubing, pneumatic valve operator tubing and flexible tubing for pressure switches.

.8 Minimum standard of installation shall be in accordance with the manufacturer's instructions.

3.6 JOINTS

.1 Apply teflon tape to male threads at screwed joints on systems which operate at less than 21°C. Use Masters Metallic on gas piping and where the service temperature is greater than 21°C.

.2 Apply Denso paste to bolt threads at expansion pieces, flanged, Victaulic and mechanical joints. For buried piping apply paste to the fasteners.

3.7 ORIENTATION OF VALVE OPERATORS

.1 Orient valves and valve operators to satisfy the following:

.1 Ease of operation.

.2 Limit interference with structures and with any other equipment or piping.

.3 Show valve position indicator from operating position.

.4 Allowance for maintenance and disassembly.

3.8 CUTTING AND PATCHING

.1 The Contractor shall confer with the Architectural and Structural Drawings and provide all cutting and patching as required in a manner approved by the Consultant.

.2 The Contractor shall liaise and coordinate with other subcontractors before walls or floors are built.

.3 The location of holes, recesses and chases, as well as any sleeves and inserts required for passage of system components through vertical and horizontal surfaces to the building. All entry and exit of pipes into and out of buildings shall be sealed by use of link-seal approved by the Consultant and acceptable to the Owner.

.4 If such provisions are not made, all remedial work shall be at the Contractor's expense and in a manner approved by the Consultant at no extra cost to the Contract.

.5 Supply labour, materials, tools and equipment to complete work of cutting and patching. Include cutting and patching of all mechanical openings regardless of size; and responsibility for damages caused to building components during the performance of mechanical cutting and patching work. Cutting and patching of any building component shall be performed by tradesman skilled in the particular work involved (i.e., masons, drywallers etc.).

.6 Cut, patch and make good so as to leave work in a finished condition. Fill any holes left in floors and walls.

.7 Cutting of any building structural element must have the Consultant's approval.

3.9 PROTECTION

.1 Protect all buildings and structures from damage during mechanical installation.

.2 Protect finished and unfinished mechanical work from damage. Maintain services and equipment dry and clean.

.3 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to the system and approved by the appropriate equipment manufacturer.

.4 Cover all openings in equipment and material. Cover temporary openings in ducts and pipes with polyethylene sheets securely tied in place or plastic pipe covers, until final connection is made, or service is permanently closed up. Cups, rags, and similar makeshift coverings are not permitted.

3.10 CLEANING

.1 Interior and exterior of all systems shall be clean upon project completion to the satisfaction of the Consultant. Where systems are not clean to the satisfaction of the Consultant, this Contractor shall cover all costs to meet the Consultant's requirements.

3.11 HOISTING AND SCAFFOLDING

.1 Perform all unloading, hoisting and warehousing for all mechanical equipment and materials and assume responsibility for damage caused to the property of the Owner in the performance of the work.

.2 Ensure that all equipment can be hoisted and set into the specified location. Include for the cost of dismantling and reassembling of equipment where required. Reassembly shall be to the equipment manufacturer's written approval.

3.12 PAINTING

.1 Deliver equipment to site painted with one heavy coat of rust resisting primer or prefinished with standard factory applied baked enamel finish unless otherwise specified. All final painting inside and outside building is by Section 09900 – Painting.

.2 Touch up any damage to prime coat. Provide coating to match original where applicable. Protect equipment and prefinished panels throughout construction period.

.3 Restore to new condition, finishes that have been damaged too extensively to be merely primed and touched up.

.4 Paint all new bolts and nuts with PVC paint after their installation.

.5 Paint new services as specifically indicated in Division 15 Sections.

3.13 SPECIAL TOOLS

.1 Provide one set of any special tools required to service equipment as recommended by manufacturers and in accordance with Section 01780 - Closeout Submittals.

3.14 TRIAL USAGE

.1 The Owner has the privilege of the trial usage of mechanical system or parts thereof for the purposed of testing and learning the operational procedures.

.2 Carry out the operations only with the express knowledge and under supervision of the Sub-Contractor who shall not waive any responsibility because of trial usage.

.3 Trial usage shall not be construed as acceptance by the Owner.

3.15 START-UP AND TESTING

.1 Fully coordinate all start-up and testing activities and ensure they are performed by manufacturer’s representatives and/or qualified technicians.

.2 Submit a copy of the start-up and testing reports to the Consultant within one week. Systems shall not be approved for use until all start-up and testing is complete and the reports have been reviewed and accepted by the Consultant.

3.16 BALANCING AND COMMISSIONING

.1 Refer to Section 15990 - Testing, Adjusting, and Balancing and Section 01825 Performance Testing.

.2 Balancing and commissioning of mechanical systems shall be performed by a Balancing and Commissioning Company independent of the Mechanical Contractor.

.3 Fully coordinate all balancing and commissioning activities and ensure that the Consultant and the Owner representatives are notified in advance as required. Obtain written approval of balancing and commissioning activities and times from the Consultant.

.4 The Mechanical Contractor shall cooperate with the independent company(ies) and perform the functions described below with respect to the balancing and commissioning of the systems.

.5 Consult with the Independent Balancing and Commissioning Company confirming the locations of all volume dampers prior to the installation of ductwork, the locations of ductwork air volume measuring ports, and the locations of balancing valves and measuring stations, etc.

.6 Provide the assistance of a qualified mechanic to assist and make all necessary adjustments as directed by the independent company and replace system components (i.e., filters) to achieve the specified system conditions for balancing.

.7 Change motor sheave, fan sheave and belts for the necessary systems as directed by the independent company to achieve final balance.

.8 Assist the authorities in all required tests with respect to operation of the systems.

3.17 DEMONSTRATION AND TRAINING

.1 Provide and pay for services of fully experienced and competent Consultant or Technician to instruct personnel designated by the Owner in proper operation and maintenance of equipment installed under this Division including controls and their functions.

.2 In addition, provide specialized instructions by respective manufacturers as may be required to fully illustrating any particular system or component.

.3 Instruct personnel designated by the Owner to ensure full comprehension of the mechanical systems up to one full working day per session. Arrange and conduct two, one day sessions or four half day sessions as requested by the Owner. Owner shall finalize instruction times.

.4 Arrange with Owner most suitable time for instruction and keep records of dates and durations of each instruction period together with name(s) of person(s) to whom instructions were given. Forward one signed copy of records to the Consultant prior to the release of holdback.

.5 Refer to Division 1 for Demonstration and Training.

END OF SECTION

SECTION 15090
SUPPORTS, ANCHORS AND SEALS

SECTION 15090
SUPPORTS, ANCHORS AND SEALS

PART 1 GENERAL

1.1 SCOPE

.1 This section covers the installation of hangers and supports for all work under this Division.

.2 Provide proper flashing and firestop sealant and collars to every wall and roof pipe and duct penetration.

1.2 RELATED SECTIONS

.1 Section 01300 – Submittals

.2 Section 15010 – Mechanical General Requirements

.3 Section 15050 – Basic Mechanical Materials and Methods

.4 Section 15080 – Mechanical Insulation

.5 Section 15142 – Domestic Water Piping – Copper

.6 Section 15152 – Drainage, Waste and Vent Piping – Plastic

.7 Section 15187 – Copper Tubing & Fitting - Refrigerant

.8 Section 15540 – Ductwork

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Fire rated penetration seals: Submit dimensional data, service limitations, installation instructions, UL certification and FM listing.

1.4 QUALITY ASSURANCE

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

1.5 ALTERNATIVES

.1 Obtain approval prior to drilling for inserts and supports for piping systems.

.2 Obtain approval prior to using percussion type fastenings.

.3 Use of existing piping or equipment for hangers supports is not permitted.

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

1.6 FIRESTOP SEALANTS AND COLLARS

.1 Standard method of fire tests of firestop system CAN4-S115-M85.

.2 UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).

.3 Seals, assemblies and materials for penetration of fire rated surfaces shall be listed by FM and certified by UL or ULC for the service application.

PART 2 PRODUCTS

2.1 GENERAL

.1 Provide all frames and supports for the proper erection of the work. Fabricate from structural steel any supporting sections and frames required. Provide chamfered edges on all concrete bases. Use only approved type hangers.

2.2 INSERTS

.1 Inserts shall be malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.3 FLASHING

.1 Steel Flashing: 26 gauge galvanized steel.

.2 Lead Flashing: 24.5 (5 lb/ft^2) sheet lead.

.3 Aluminum flashing: 26 gauge sheet aluminum.

2.4 FIRESTOP SEALANTS AND COLLARS

.1 Firestop Sealants and collars to provide mechanical fire protection for penetrations utilizing PVC or CPVC pipe, PVC conduit, polyethylene conduit or pipe, other nonmetallic pipes, cables, and combustible pipe insulations as the penetrant.

.2 Intumescent insert: Flexible, elastomeric strip, two stage expansion, designed to firestop penetrations in fire-rated walls and floors and floor/ceiling assemblies.

.3 Provide a minimum of 15 time free expansion.

.4 Contain no water soluble expansion ingredients.

PART 3 EXECUTION

3.1 GENERAL

.1 Provide all frames and supports for the proper erection of the work. Fabricate from structural steel any supporting sections and frames required. Provide chamfered edges on all concrete bases. Use only approved type hangers.

.2 Support hangers directly from structure. Do not support pipes or other equipment from other pipes, ducts, equipment, suspended ceilings or metal roof decks, etc.

.3 Suspend hanger rods from inserts in concrete or from beam clamps. Obtain the Engineer's approval prior to welding to steel structural members. Ensure that load imposed on structure does not exceed structural design load. Suspend from top chords of steel joists or top or bottom flange of steel beams using beam clamps.

.4 Include angle frames, anchor bolts, guy wires, platforms, braces, etc. required to support equipment, ductwork, piping, etc.

3.2 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Use factory made, threaded or toggle type inserts for supports and anchors, sized for load to be carried. Place inserts only in portions of main structure and not in any finishing material.

.3 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100mm or ducts over 1500 mm wide.

.4 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.5 Use factory made expansion shields where inserts cannot be placed but only where approved by the Engineer and only for light weights. Make holes for inserts using drill, no ram setting permitted.

.6 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

.7 Expansion bolt type connections will be approved under certain conditions. Obtain approval from the Consultant. Generally, pipe 50 mm or smaller, and ducts less than 600 mm x 300 mm will be approved, subject to adequate number of support points.

3.3 PIPE HANGERS AND SUPPORTS

.1 Provide pipe hangers with supports for piping in Division 15 with rods vertical, without bends or offsets such that finished piping is true, both with respect to line and grade.

.2 Fasten hangers and supports to building structure or inserts in concrete construction.

.3 Do not use pipe hooks, chains, or perforated straps.

.4 Use angle or channel welded frames for trapeze hangers.

.5 Hangers for uninsulated pipes to be Grinnel Fig. 65 adjustable clevis up to including 100 mm and Grinnel Fig. 260 adjustable clevis for sizes 125 mm and larger, or approved equal.

.6 Hangers for insulated pipes with hanger around insulation to be provided with insulation shield, minimum 300 mm long, 18 gauge, galvanized sheet metal between insulation covering and hanger. Tack weld shield to hanger.

.7 For support of horizontal piping use round steel threaded rod having the following diameters and spaced at the following intervals:

STEEL PIPE		
PIPE DIAMETER (mm)	HORIZONTAL SPACING OF SUPPORTS (mm)	THREADED ROD DIAMETER (mm)
12	1500	10
20	1800	10
25	1500	10
32	2400	10
40	2700	10
50	3000	10
65	3300	13
75	3600	13
100	4200	16
150	5100	19
200	5100	22

COPPER TUBING, ANNEALED STEEL TUBING AND PVC PIPING AT MAXIMUM 40Ec		
PIPE DIAMETER (mm)	HORIZONTAL SPACING OF SUPPORTS (mm)	THREADED ROD DIAMETER (mm)
13	1500	10
20	1500	10
25	1800	10
32	2100	10
40	2400	10
50	2400	10
65	3200	13
75	3200	13
100	3600	16

.8 Install hangers to provide minimum 32 mm clear space between finished covering and adjacent work.

.9 Place a hanger within 300 mm of each horizontal elbow.

.10 Use hangers which are vertically adjustable 38 mm minimum after piping is erected.

.11 Support vertical piping at every floor. Support vertical pipes with riser clamps or ring stays. Spacing of vertical pipe supports to conform with spacing of horizontal supports.

.12 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.13 Where practical, support riser piping independently of connected horizontal piping.

.14 Support horizontal soil pipe near each joint, with 1.5 m maximum spacing between hangers.

.15 Where pipes change direction either horizontally or vertically provide pipe hanger not more than 300 mm from elbows. Where pipes drop from branches of tees support main run in both directions not more than 900 mm on each side of tee. Where changes in direction are used for expansion, use linked eye hanger rods.

.16 Exposed piping, with less than 2.6 m clearance to floors shall be provided with two times the number of hangers normally required. Spacing shall be equal or adjusted for maximum benefit.

.17 Provide copper plated hangers and supports for copper piping or provide nonferrous packing between hanger or support and piping.

.18 Large capacity piping with vibration potential shall not be suspended from any building structure that will allow transfer of vibrations to the occupied spaces.

.19 Pack annular spaces between openings and piping in walls with waterproof, non-hardening mastic as approved by the Engineer. At exterior surfaces caulk to form a smooth and neat seal against wall. Apply a layer of denso tape to the gas piping to protect same prior to filling the void.

3.4 EQUIPMENT HANGERS AND SUPPORTS

.1 Erect structural work required for support of mechanical equipment. Supports to have ample strength to carry equipment under testing and operating conditions. In addition, supports must meet normal acceptable engineering practices and be approved by the Engineer.

.2 Include suitable bases or mounting brackets with mechanical equipment.

3.5 EQUIPMENT BASES AND SUPPORTS

.1 Concrete housekeeping pads are specified under other divisions. Bases shall be 100mm thick minimum, extended 150 mm minimum beyond machinery bedplates. This Division will provide templates anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Provide rigid anchors for ducts and pipes immediately after vibration connections to equipment.

.4 Suspend mechanical equipment from structure with adjustable length steel rods. Provide spreader beams to distribute weight.

3.6 NOISE AND VIBRATION CONTROL

.1 Use the type of isolation equipment to obtain optimum results, consult with the isolator manufacturer to provide installation instructions for his product.

3.7 PRIMING

.1 Prime coat all steel hangers and supports.

3.8 FLASHING

.1 Where mechanical equipment passes through weather or waterproofed walls and roofs, counter flashing shall be provided under this Division. Roof flashing is specified under other divisions of this specification.

3.9 SLEEVES

.1 Provide and set sleeves required for equipment, including openings required for placing equipment.

.2 Set sleeves in position in advance of other work. Provide suitable reinforcing around sleeves.

.3 Extend sleeves through potentially wet floors 50 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.4 Where ductwork passes through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Provide tight fitting metal caps on both sides.

.5 Where piping passes through floor, ceiling or wall, close off space between pipe and sleeve with non-combustible insulation or approved non-combustible insulation, fire rated as required to match the rating of the penetrated surface. Provide tight fitting metal caps on both sides.

.6 Install chrome plated escutcheons where piping passes through finished surfaces.

.7 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

3.10 FIRESTOP SEALANTS AND COLLARS

.1 Clean all concrete, masonry and stone penetrations of all contaminants and impurities, concrete form release agents, water repellents, oils, surface dirt and rust, scale, all old sealants and other surface treatments.

.2 Metal surfaces shall be cleaned by wiping them with an oil- free absorbent cloth saturated with solvent such as xylol or toluol. Do not use alcohols.

.3 Do not apply to polycarbonates or to building materials that bleed oils, plasticizers or solvents, or where sealant is not exposed to atmospheric moisture, or to surfaces which have been or will be painted.

.4 Collars are to be installed with steel fasteners or steel expansion anchors. Low melting temperature anchors of lead, plastic or aluminum are not approved.

.5 Installation only when temperatures are between 4ºC (40ºF) and 37ºC (98°F).

3.11 LABELLING AND PAINTING

.1 Refer to Section 15075 – Equipment, Piping and Valve Identification.

.2 Painting of any ductwork and hangers is by Division 9 – Finishes.

END OF SECTION

SECTION 15305
FIRE EXTINGUISHERS

SECTION 15305
FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SCOPE

.1 Supply and install fire extinguishers indicated on the drawings and at position to meet all codes. Fire extinguishers shall be installed in a surface mounted fire extinguisher cabinet as specified herein.

1.2 RELATED SECTIONS

.1 Basic Mechanical Materials and Methods: Section 15050

1.3 SHOP DRAWINGS

.1 Submit shop drawings for all products specified in this section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Material shall be stored and handled in accordance with manufacturer's instruction.

PART 2 PRODUCTS

2.1 GENERAL

.1 All fire extinguishers are to be pressurized rechargeable type, in accordance with NFPA 10 and ULC listed and labelled for the class of fires for which they are specified.

.2 Each fire extinguisher shall be complete with:

.1 Manufacturer's identification label attached indicating that the extinguisher model number, rating and operating instructions.

.2 Anodized aluminium or chrome plated forged brass valve with positive squeeze grip on-off operation and a pull-pin safety lock.

.3 Discharge hose with nozzle or horn and hose securing clip.

2.2 DRY CHEMICAL EXTINGUISHER

.1 Multi-purpose dry chemical (ammonium phosphate) power extinguishers are with not less than 4.5 Kg content, red baked enamel finish and waterproof stainless steel gauge suitable for Class A, B & C fire and is fitted with a pressure gauge.

2.3 FIRE EXTINGUISHER WALL BRACKETS

.1 Fire extinguisher wall brackets shall be rust, dent and fade resistant.

2.4 ACCEPTABLE MANUFACTURER:

.1 National Fire Equipment, Strike First, Model SF-ABC680 with wall hanger.

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE EXTINGUISHER

.1 Provide fire extinguisher indicated in the locations shown on the drawings. Mounting height shall meet NFPA 10 requirements and local authority having jurisdiction.

.2 Fire extinguishers shall be installed inside fire extinguisher cabinet. Do not install the bracket until the wall is finished, primed and painted.

.3 Extinguishers located beside doors, mount extinguisher at the strike side of the door.

END OF SECTION

SECTION 15500
ELECTRIC HEATING

SECTION 15500
ELECTRIC HEATING

PART 1 GENERAL

1.1 SCOPE

.1 This section specifies the design, shop drawing submission, supply, manufacturing, installation, testing, training and commissioning of electrical unit heaters.

.2 Furnish all labour, materials, tools and equipment for the installation of Heating Systems generally as shown on the drawings and specified herein.

.3 Furnish and install unit heaters in locations and elevations as shown on the drawings.

.4 Provide and install controls, thermostats and accessories needed to complete a fully functioning system.

1.2 GENERAL REQUIREMENTS

.1 Refer to General Conditions and Division 1.

.2 All equipment shall be CSA approved and ULC listed.

1.3 REFERENCE STANDARD

All referenced Standards and Codes shall be of the latest editions.

.1 Electrical Wiring and Equipment - CSA C22.l with Ontario Hydro Amendments.

.2 Heating and Vent - NFPA 90A and B.

.3 ANSI/ASHRAE Standard 70-1991.

.4 ANSI/NFPA 70 – National Electric Code.

.5 ASTM E90, Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

.6 ANSI/ASHRAE Standard 70-1991.

.7 ANSI/ASHRAE/IESNA 90.1-1999 – Energy Standard for New Buildings Except Low-Rise Residential Buildings.

.8 ASHRAE Standard 51.

.9 ASHRAE Standard 62.

.10 AMCA Standard 210.

1.4 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 15010 – Mechanical General Requirements.

.2 Section 15050 - Basic Mech Materials and Methods

.3 Section 15990 – Testing, Adjusting, Balancing.

.4 Division 13 and 16.

1.5 SHOP DRAWINGS

.1 Provide shop drawings according to Division 1 requirements and as listed below.

.2 Product data to include: Mounting methods, physical size, layout and diagrams of unit heaters kW rating, voltage, phase, finish.

.1 Unit heaters:

.1 Specification, descriptive drawings, catalogue cuts and descriptive literature which shall include make, model, dimensions, electrical / control schematics, and weight of equipment.

.2 Complete performance data that will indicate full compliance with the specifications.

.3 Detail instruction on recommended procedure for the protection and handling of materials prior to installation.

.4 List of recommended spare parts.

.5 Compliance with the Codes.

.6 Operating and maintenance manuals and maintenance summary.

.2 Thermostats.

1.6 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 PRODUCTS

2.1 FORCE FLOW HEATERS

.1 Refer to drawings for heater schedules and locations

.2 Finish: Epoxy/polyester powder paint.

.3 Construction:

a) 18-guage steel front cover.

b) Bottom air outlet

c) High limit temperature control with automatic reset.

.4 Fan – Closed, factory-lubricated motor. Fan relay purge heater.

.5 Heating element: Durable tubular heating with fins.

.6 Control: Built-in thermostat with control knob.

.7 Acceptable Manufacturer:

.1 Ouellet model OAC

.2 Approved equivalent

2.2 ELECTRIC CONVECTION HEATER

.1 Refer to drawings for heater schedules and locations

.2 Construction:

a) 16-gauge steel front cover

b) 18-gauge satin coat steel cabinet

.3 Finish: Standard: Epoxy/polyester powder paint.

.4 Extruded aluminum bar grilles prevent insertion of foreign objects

.5 Linear high-limit temperature control with automatic reset.

.6 Full-length built-in wireway.

.7 Heating element:

.8 Two stainless steel tubular heating elements with aluminum fins.

a) Floating heating element on high temperature nylon bushings reducing expansion noises.

.9 Control

a) Built-in thermostat with a control knob.

.10 Acceptable Manufacturer:

.1 Ouellet model OPI

.2 Approved Equivalent

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install unit heaters as indicated, and to manufacturer’s instructions.

.2 Install heaters only after wall is finished, primed and painted (if applicable).

.3 The installation height is as recommended by supplier (to be confirmed on site).

3.2 HEATERS

.1 Install heaters in locations shown, without interference and ensure all mounting brackets, hardware, etc. are securely attached.

.2 Ensure that manufacturer's instructions are followed, air passages are clean, motors operate freely and controls operate properly.

.3 Refer also to Division 13 and 16 for general requirements for installation of equipment specified herein.

3.3 EQUIPMENT SUPPORTS

.1 Mount equipment supported above floors on approved welded galvanized structural steel framework with diagonal bracing and floor and wall plates.

.2 Unless otherwise shown on the Drawings, construct framework of 75 x 75 x 6 mm angles hot dip galvanized after fabrication.

.3 Hang suspended equipment on 13 mm minimum diameter galvanized hanger roads attached to the building structure.

3.4 DEMONSTRATION

.1 Demonstrate to the Engineer the proper operation of all systems.

.2 Instruct the Owner's staff in the proper operation and maintenance of the equipment using the Equipment Manufacturer's printed material.

3.5 TESTING AND BALANCING

.1 Prior to unit startup, all system components shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory operation. The Manufacturer’s representative shall inspect the installation of equipment including mechanical and electrical connections, necessary lubrication and adjustments, and provide certification that the unit have been installed correctly and it is ready for operation.

.2 Test all heaters and measure current draw and provide a written report.

.3 Test to include checks for excessive vibration, correct operation of control systems and equipment, motor power input, acceptable normal running noise, speed and direction of rotation.

.4 Test to demonstrate that the equipment and work is not defective electrically, mechanically, or otherwise and is safe and satisfactory.

.5 Check calibration of thermostatic controls are set as per drawing requirements.

.6 Check operation of all safety and over-temperature cut-outs.

3.6 COMMISSIONING

.1 Commission equipment in accordance with Division 1

.2 In addition, provide the services of a factory-trained and **certified** technician for one (1) day to calibrate and confirm the correct installation, operation and written certification of the equipment. Modify the installation as per his recommendations (if any).

.3 Schedule time for startup and commissioning. Provide instruments, meters, equipment and personnel. Demonstrate unit operation. The system shall be tested in all operational modes. Carry out tests in the presence of Engineer and Owner.

.4 Certify commissioning in accordance with Divisions 1.

3.7 TRAINING

.1 Training shall be provided in accordance to Division 1 requirements.

.2 Allows one (1), 2-hour session for each system. The schedule shall be discussed with and approved by the Owner. The sessions shall be completed prior to commissioning.

3.8 MANUFACTURERS SERVICES

.1 Manufacturer's representative for the equipment specified shall be present at each jobsite for installation assistance, inspection and certification of the installation, equipment testing, startup assistance and training of the owner's personnel, for the period of (per each job site):

.1 Minimum of 8 hours – installation, assistance & certification.

.2 Minimum of 4 hours – testing.

.3 Minimum of 4 hours – training.

.2 Minimum number of trips two (2) per each site.

END OF SECTION

SECTION 15740
AIR CONDITIONING EQUIPMENT

SECTION 15740
AIR CONDITIONING EQUIPMENT

PART 1 GENERAL

1.1 SUBMITTALS

.1 Refer to Section 01300 – Submittals for detailed requirements.

.2 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.

.3 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this Section.

.4 Prepare and submit a schematic layout of refrigerant piping showing all piping components required for satisfactory operation and maintenance of the system(s), including but not limited to pipe sizes, charging valve, isolating valves, sight glasses, strainers, driers, traps, etc. Schematic diagram must be reviewed with and approved by air conditioning equipment supplier prior to submittal to Consultant.

1.2 QUALITY ASSURANCE

.1 The air conditioning equipment and installation of equipment are to be in accordance with requirements of following:

.1 All applicable Provincial Codes and Standards.

.2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

1.3 WARRANTY

.1 All equipment shall be provided with a 24-month warranty commencing at Substantial Performance.

PART 2 PRODUCTS

2.1 AIR CONDITIONING EQUIPMENT

.1 Factory assembled and tested, package type equipment consisting of an indoor evaporator unit and an exterior condensing unit in accordance with drawing schedule, CSA or ETL listed and labelled, AHRI rated and certified and with a minimum system efficiency of 19 SEER.

.2 The PEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The PEFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY shall support individual control using M-NET DDC controllers.

.3 Factory run tested, weatherproof condensing unit equipped with a control board to interface with indoor unit and perform all necessary operation functions. Pre-charge unit with R-410a refrigerant for a minimum of 21 m (70 ft.) of refrigerant tubing. Unit is to be capable of operation at -18°C (0°F) without additional low ambient controls, and capable of a height difference between condensing unit and evaporator of 30 m (100 ft.). Each condensing unit complete with:

.1 Galvanized steel plate cabinet with an electrostatically applied thermally fused polyester powder finish, and an ABS plastic fan grille.

.2 Draw-through direct driven balanced fan with horizontal air discharge, mounted in front of coil, arranged to pull air across coil, and equipped with a raised fan guard.

.3 “L” shaped coil with copper tubes and aluminium fins, factory pressure tested, complete with an integral metal guard and refrigerant flow controlled by a linear expansion valve metering orifice controlled by a microprocessor controlled step motor.

.4 Vibration isolated DC rotary compressor driven by an inverter circuit to dynamically control compressor speed to match room load, complete with an accumulator, high pressure safety switch, and circuitry to permit a minimal amount of current to be applied to motor to maintain enough heat during off cycle to prevent liquid from accumulating.

.4 System controls consisting of a microprocessor in each indoor and outdoor unit, and an indoor wall mounted controller site connected to indoor evaporator unit. System is to be capable of automatic restart after power interruption, and have self-diagnostics ability and indication of total compressor run time, and following:

.1 Indoor unit microprocessor is capable of monitoring return air temperature and evaporator coil temperature, receiving and processing commands from wall mounted controller, providing emergency operation, and controlling outdoor unit through its microprocessor and interface board.

.2 Controller is complete with an integral temperature sensor, able to perform input and output functions necessary to operate system, and equipped with following:

.1 Large DOT liquid crystal display to indicate diagnostic codes for both indoor and outdoor units, compressor run time, a weekly

timer with up to eight (8) pattern settings per day, set temperature, room temperature, refrigerant piping temperatures, compressor operating conditions, and linear expansion valve opening pulses, sub-cooling and discharge super heat.

.2 On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louvre Swing button, a Ventilation button, a Test Run button, and a Check Mode button.

.5 Acceptable manufacturers are:

.1 Mitsubishi

.2 LG Electronics Canada Inc.

.3 Fujitsu General America Inc.

.4 Daikin Industries Ltd.

.5 Equivalent

PART 3 EXECUTION

3.1 INSTALLATION OF SPLIT SYSTEM AIR CONDITIONING EQUIPMENT

.1 Provide split system air conditioning equipment consisting of an exterior condensing unit and an indoor evaporator.

.2 Secure condensing unit in place, level and plumb, on vibration isolation pads on a concrete housekeeping pad.

.3 Mount indoor evaporator unit. Confirm exact location prior to roughing-in.

.4 Connect condensing unit and indoor evaporator with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section entitled Refrigerant Piping, Valves, and Accessories. Provide any required additional refrigerant.

.5 Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer’s control wiring schematic and wiring standards of electrical work.

.6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.

.7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

.8 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with control set-up and abnormal events.

END OF SECTION

SECTION 15990
TESTING, ADJUSTING, AND BALANCING

SECTION 15990
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Component check

.2 System balancing

.3 Operating tests and training.

1.2 RELATED SECTIONS

.1 Basic Mechanical Requirements – Section 15010

Ductwork and Accessories – Section 15810

.2 Fans and Accessories – Section 15815

.3 Electrical – Division 16

1.3 REGULATIONS

.1 Conform to all codes, by-laws, etc. of Provincial and Municipal authorities having jurisdiction.

.2 American National Standards Institute (ANSI)

.1 ANSI S12.1 Physical Measurement of Sound

.3 Associated Air Balance Council (AABC)

.1 AABC 12173 National Standards for Field Measurements and Instrumentation — Total System Balance.

1.4 SUBMITTALS

.1 Testing and Balancing Report: All test forms shall be standard 8-1/2 x 11-inch (A4 size), good-quality paper, bound to form a complete report. All forms shall be computer printed, typewritten, or legibly hand lettered; hand-made forms are not acceptable. Submit draft copies prior to final acceptance of the project. Refer to subpart 3.5 “Balancing Report” for specific requirements.

.2 Submit all manuals required under this section.

1.5 QUALITY ASSURANCE

.1 Obtain the services of a qualified balancing organization to perform testing, balancing, and component check at no additional cost to the Owner. The balancing agency shall be independent of the air-conditioning installer.

.2 Perform checks before testing and balancing.

.3 Perform balancing in accordance with AABC 12173.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

.1 Ensure the balancing organization checks and reports defects or deficiencies that may affect balancing.

.2 Provide sufficient time before completion date to balancing operations.

.3 Provide immediate labour and tools to make corrections without delay.

.4 Place heating, ventilating, and air-conditioning systems and equipment into full operation and continue operation for each working day of testing and balancing.

.5 Advise balancing organization of changes made to the system during construction.

.6 Install required test holes complete with removable and replaceable plugs.

.7 Make necessary revisions to controls, dampers, and fan and pump drives, and consult with equipment manufacturers as required to achieve the specified system's performance.

.8 Provide dampers as shown and where required to obtain final system balance.

.9 Provide ladders, scaffolds, and tools and labour required to facilitate balancing, including removing ceiling tiles and guards, and adjusting pulleys and belts. Reinstall and adjust all items when balancing is finished.

.10 Coordinate balancing operations with controls system installation when setting damper linkages and minimum-outside-air dampers. Readjust dampers and improperly calibrated controls as required.

.11 Set pressure-regulating and reducing valves to operating conditions.

.12 Check air filters immediately prior to air balancing.

.13 Open fire dampers (if applicable).

3.2 EQUIPMENT CHECK

.1 Check all equipment according to the manufacturer's instructions and the following checklist:

.1 Pre-Startup Inspection:

.1 Verify proper equipment mounting and setting.

.2 Verify that control, interlock, and power wiring is complete.

.3 Verify alignment of motors and drives.

.4 Verify proper piping connections and accessories.

.5 Verify that lubrication is completed.

.2 First Run Observations:

.1 Verify direction of rotation.

.2 Verify setting of safety controls.

.3 Monitor heat buildup in bearings.

.4 Check motor loads against nameplate.

.3 Equipment Check:

.1 Verify proper overload heater sizes.

.2 Verify function of safety and operating controls.

.3 Verify proper operation of equipment.

.4 Report on inspection, observation, and checking procedures.

3.3 CHECK ALL SUBSYSTEMS PRIOR TO SYSTEM BALANCING

.1 Air distribution products installation is completed.

.2 Filter installation is completed.

.3 Instrumentation installation is completed.

.4 Refrigeration systems have been leak tested, evacuated, and filled with refrigerant and fresh oil (if applicable).

.5 Equipment check completed.

.6 Rotation of electric motor and ratings of overload heaters have been verified.

.7 Rotating equipment has been aligned and belt drive tension has been adjusted.

.8 Control diagrams and sequences have been corrected to “as-built.”

.9 Safety and operating control SET POINTS are as designed, and automatic control sequences have been checked.

.10 Installation has been cleaned-up and temporary coverings, stickers, and tags removed.

.11 Equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.

.12 One set of operating and maintenance manuals has been prepared especially for use by testing and balancing technicians.

.13 Building operating and maintenance personnel have been instructed in all aspects of system operation and maintenance.

.14 Graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.

3.4 AIR-SYSTEM BALANCE PROCEDURE

.1 Note: Wet Wells of Pumping stations are hazardous areas (Class 1 Div. 1/Zone 1 Group G). Equipment used to perform TAB shall be rated for hazardous areas. All health and safety procedures and equipment needed for the TAB work shall be full responsibility of the Contractor and be priced accordingly.

.2 Execute air systems balancing for each air system in accordance with AABC specifications and as described herein.

.3 Make tests with supply, return and exhaust systems operating and doors and windows closed, or in their normal operation condition.

.4 Test and adjust blower speed to design requirements.

.5 Test and record motor full-load amps.

.1 Traverse main supply-air ducts, using a Pitot tube and manometer. Calibrate the manometer to read two significant figures in velocity pressure ranges. Take a minimum of 16 readings per traverse to measure the total air quantity supplied by the fan, and to verify air distribution per zone

.6 Test and record required and measured system static pressures, filter differential, coil differential, and fan total static pressure.

.7 Test and adjust systems for design recirculated airflow rates.

.8 Test and adjust system for design volume flow rate of outside air (L/s).

.9 Test and record entering-air temperatures.

.10 Test and record leaving-air temperatures.

.11 Adjust main supply and return ducts to proper design flow rates.

.12 Inspect and confirm all fire dampers are open and have adequate access.

.13 Adjust zones to proper design, supply and return flow rates.

.14 Test and adjust each diffuser, grille and register to within 10% of design requirements.

.15 Identify each diffuser, grille and register as to location and area.

.16 Identify and list size, type and manufacturer of diffusers, grilles, registers and testing equipment. Use manufacturer's rating on equipment to make required calculations.

.17 In readings and tests of diffusers, grilles and registers, include required velocity and test velocity (m/s) and required flow rate (L/s). Test after adjustment.

.18 Control manufacturer shall set adjustments of automatically operated dampers to operate as indicated in cooperation with balancing firms.

3.5 BALANCING REPORT

.1 Include types, serial numbers and dates of calibration of instruments.

.2 Drawings, and submit copies upon completion of balancing.

.3 Submit fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and diffusion factors.

.4 Index report as follows:

.1 Air

.2 Summary

.3 Procedure

.4 Instrumentation

.5 Drawings

.6 Equipment Summary

.7 Fan Sheets

.8 Fan Curves

.9 Fan Profile Data

.10 Static Data

.5 Fire Damper Verification:

.6 Air-Handling Equipment:

.1 Installation Data:

.1 Manufacturer

.2 Size

.3 Arrangement, discharge and class

.4 Motor type, power (hp or W), rpm, voltage, phase, cycles and full-load amps

.5 Location and final identification

.2 Design Data:

.1 Total airflow rate

.2 Static pressure

.3 Motor power (hp or W), rpm and amps

.4 Fan rpm

.5 Fan power (hp or W)

.6 Inlet and outlet dry-bulb temperatures

.3 Recorded Data:

.1 Airflow rate

.2 Static pressure

.3 Fan rpm

.4 Fan power (hp or W)

.5 Motor operating amps

.6 Inlet and outlet dry-bulb temperatures and wet-bulb temperatures

.7 Duct Air Quantities:

.1 Duct sizes

.2 Number of pressure readings

.3 Sum of velocity measurements

.4 Average velocity

.5 Duct recorded airflow rate

.6 Duct design airflow rates

.8 Air Inlets and Outlets:

.1 Outlet identification location and designation

.2 Manufacturer’s catalogue identification and type

.3 Application factors

.4 Design and recorded velocities

.5 Design and recorded airflow rates

.6 Deflector-vane or diffuser-cone settings

.9 Building Pressurization Data:

.1 Outside air temperatures

.2 Outside wind velocity

.3 Building pressures plotted with respect to systems

.4 Supply-air, return-air and exhaust-airflow rates

.5 Locations of pressure measuring points inside and outside building

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS

SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS

SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 In case of a discrepancy between statements and/or values in this General Requirements section and contract drawing(s), the more stringent statement and value takes precedence and shall govern.

1.2 RELATED SECTIONS

.1 Section 01300 – Submittals.

.2 Section 01740 – Cleaning.

.3 Section 01780 – Closeout Submittals.

1.3 DEFINITIONS

.1 The following are definitions of terms and expressions used in the specification:

.1 "Inspection Department/Authority" means the agency having jurisdiction over construction and safety standards associated with any part of electrical work on site. For this project, the Inspection Departments/ Authorities are the Electrical Safety Authority (ESA).

.2 "Supply Authority" means the local electrical distribution company. For this project the Supply Authority is Hydro One Markham.

.3 "Electrical Code" means the Ontario Electrical Safety Code latest Edition, and published bulletins.

.4 "Indicated" means as shown on contract drawings or noted in contract documents.

.2 Refer to CSA C22.2 No.0 for "Definitions and General Requirements".

.3 Abbreviations for electrical terms shall be in accordance with CSA Z85-1983.

1.4 CODES AND STANDARDS

.1 All equipment and installations including temporary works shall comply with the latest editions of the Canadian Electrical Code – CSA C22.1, the Ontario Hydro Safety Code and any local codes and requirements that govern the installation. Where these regulations conflict, apply the most stringent condition.

.2 Install overhead and underground systems in accordance with CSA C22.3 No.1-M87 and No.7-M86 and No2 except where specified otherwise.

.3 Building Code of Ontario, O.Reg.413/98, Latest Revision.CAN3-C235-83 Voltages

.4 Abbreviations for electrical terms to CSA Z85-Latest Revision.

1.5 SCOPE OF WORK

.1 As indicated on drawings.

.2 Provide support to other disciplines as necessary.

.3 Create a sequence of construction and provide for review.

.4 Test and commission all new and modified equipment, power distribution and control systems.

.5 Clean all electrical equipment.

.6 Provide training for all equipment supplied under this Division.

.7 All cable routes to be finalized by Contractor on site including those not shown on drawings.

1.6 DRAWINGS AND SPECIFICATIONS

.1 The General Conditions, Supplementary Conditions and Division 1 are a part of this specification and shall apply to this Division.

.2 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.

.3 Many of the drawing depictions are intended to be partially diagrammatical rather than precise layouts. In such instances, do not scale locations of devices from electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.4 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.

.6 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, consult the Consultant for clarification before submitting tender.

.7 In case of a discrepancy between statement(s) or value(s) in this General Requirements section or contract drawing(s), the more stringent statement or value takes precedence and will govern.

1.7 CARE, OPERATION AND START-UP

.1 Instruct Consultant and operating personnel in the operation (testing), care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service Consultant to supervise startup of installation, check, adjust, balance and calibrate components.

.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 all aspects of its care and operation.

1.8 VOLTAGE RATINGS

.1 Operating voltages to CAN3-C235-83.

.2 Motors, control and distribution devices and equipment to operate satisfactorily at 60Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.9 PERMITS, FEES AND INSPECTION

.1 Consultant has submitted to the Inspection Authority drawings and specifications for review.

.2 The Electrical Safety Authority has reviewed the submission. A copy of their response will be provided in the appendix to this section.

.3 Submit to Consultant necessary interim and final certificates of inspection and approval required by Inspection Authorities as evidence that work installed complies with laws and regulations of governing authorities.

.4 Submit copies of plans and specifications required by Inspection.

.5 Notify the Electrical Inspection Department with sufficient time in advance for them to arrange to inspect work.

.6 Submit Inspection Authorities approval certificates.

.7 Contractor to submit a request to the Electrical Safety Authority to notify them of the impending assignment for review and inspection requirements.

.8 Provide Inspection Department any additional necessary number of drawings and specifications for examination and approval prior to commencement of work.

.9 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.10 Furnish Certificates of Acceptance from Electrical Inspection Department having jurisdiction on completion of work to Consultant.

.11 Pay all associated fees and costs. The contractor is responsible for all fees and costs including any changes, or additions in scope to the Electrical Safety Authority inspection fees.

1.10 CO-ORDINATION WITH OTHER TRADES

.1 Be responsible and co-ordinate other sub-trade work with electrical requirements and ensure that there is no interference with or delay caused by such work to the electrical or other trades work.

.2 Provide all cables, conduits, installation services and all other electrical components for other divisions within the contract, unless these services are specifically identify as not provided by Division 16.Notify other sub-trades of all openings, inserts, anchors, sleeves, hangers, foundations, etc., necessary for electrical work, and be responsible that these are provided and correctly installed at the proper time.

.3 Fully co-operate with all trades in the provision and maintenance of electrical power in all areas throughout the period of construction.

1.11 CONSTRUCTION/SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01300 – Submittals.

.2 Submit data (drawings) for review prior to commencement of manufacturing or installing with the exception of conduit, standard conduit fittings and low voltage wiring.

.3 Prior to submitting the shop drawings to the Consultant, review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.

.4 Show all details of construction, dimensions, capacities, weights, and electrical performance characteristics of equipment or material. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other

equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Prepare composite construction drawings, fully dimensioned of cables, conduit, cable tray, bus duct, sleeves, clearances, pipes, ducts, etc., and equipment in mechanical and electrical equipment rooms, ceiling spaces and all other critical locations to avoid a conflict of trades. Base drawings on manufacturer's shop drawings. Drawings should be developed from consultation with and agreement of all trades involved.

.6 Prepare drawings of equipment bases, anchors, slabs, floor and roof curbs, if needed, for the electrical work.

.7 Include, but not necessarily limit to, the following:

.1 Single Line Diagram (SLD).

.2 Manufacturer's bulletins, leaflets and specifications of major electrical equipment.

.3 Elementary control diagrams for motor starters, control circuits, Include wire numbering system.

.4 Instrumentation signal loop diagrams showing all loop devices as per ISA S5.1 and S5.4, including power supplies.

.5 RPU connection and inter-connection wiring diagrams, showing wiring, cables, jacks between components including power supplies, processor, communication modules, racks, I/O modules and peripherals, etc.

.6 Instrument and control panel layouts, and all auxiliary controls and indicating panels.

.7 Lighting fixtures, including photometric data.

.8 Indicate the number or letter used on the drawings/specifications as an identification symbol on product data for panelboards, light fixtures, instruments and other equipment submitted.

.9 Bind one complete set of construction/shop drawings showing "as built" conditions in each operating and maintenance instruction manual.

1.12 RECORD DRAWINGS

.1 Submit record drawings in accordance with Section 01300 – Submittals and Section 01780 – Closeout Submittals.

.2 The Contractor shall print and keep one complete set of white prints at the site office, including all addenda, change orders, site instructions, clarifications and revisions for the purpose of record drawings.

.3 Before commencing work, obtain two sets of electrical drawings for showing "As Built" conditions. As job progresses, mark on field set of prints to indicate accurately all installed work. At completion stage, transfer all information onto master set of drawings and indicate "Contractors Certified Approval of Accuracy" before submitting to Contract Administrator for review and record use.

.4 Indicate on record drawings "As Built" stamp.

.5 Indicate on record drawings, location of all buried services. This information is to be certified correct by Contract Administrator before backfilling commences.

.6 Include with the record drawings, a list of all motors indicating motor or equipment number and name, name-plate voltage, horsepower and current, the size of overload and breaker or fuse protection provided for each motor.

1.13 WORKMANSHIP

.1 Execute all work in a competent manner and to present an acceptable appearance when completed.

.2 Install all equipment, conduit and cables in a workmanlike manner to present a neat appearance and to function properly.

.3 Install exposed conduit runs parallel and perpendicular to building planes. Install conduit concealed in chases, behind furring, or above ceiling, except in unfinished areas. Install exposed systems and equipment neatly and grouped to present a neat appearance, without conflict to other services.

.4 Employ a competent supervisor and a sufficient number of licensed tradesmen to complete the Work in the required time.

.5 Arrange and install products to fit properly into designated building spaces.Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore, in terms of space and accessibility.

.6 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

.7 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers' installation instructions, and make provision for future plant and equipment as shown.

.8 Replace without extra cost work unsatisfactory to the Contract Administrator.

.9 Protect all equipment from damage during delivery to the site and during installation. Make good any damage or deterioration whatsoever and have it covered by replacement guarantee.

1.14 MATERIALS AND EQUIPMENT

.1 Equipment and material must be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department. Pay all associated fees.

.2 Factory assemble control panels and component assemblies.

.3 Provide Canadian manufactured equipment and materials, except where specified otherwise or where Canadian made materials or equipment do not exist.

1.15 FINISHES

.1 Shop finish all metal enclosure surfaces by application of rust resistant primer and at least two coats of finish enamel all in accordance with the directions of the coating manufacturer.

.1 Paint free-standing distribution enclosures light grey to ANSI #61.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.16 EQUIPMENT IDENTIFICATION

.1 Supply and install identification nameplates on all equipment such as motor starters, control panels, and any equipment not so supplied.

.1 Starters, contactors, Disconnects (Designation, voltage, load controlled)

.2 Panelboard (Designation, voltage, bus capacity)

.3 Control panels (designation, system, voltage)

.4 Terminal cabinets, junction boxes and pull boxes (system, voltage)

.5 Transformers (designation, capacity, primary and secondary voltage)

.2 Nameplates:

.1 Lamicoid 3mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws.

.2 Do not use self-adhesive nameplates.

.3 Use rivets, nut and bolts where access may conflict with a protruding screw point.

NAMEPLATE SIZES

Size 1	10 x 50mm	One line	3mm high letters
Size 2	12 x 70mm	One line	5mm high letters
Size 3	12 x 70mm	Two lines	3mm high letters
Size 4	20 x 90mm	One line	8mm high letters
Size 5	20 x 90mm	Two lines	5mm high letters
Size 6	25 x 100mm	One line	12mm high letter
Size 7	25 x 100mm	Two lines	6mm high letters

.3 Issue nameplates lists, for review. Wording on nameplates is to be approved by Consultant prior to manufacture.

.4 Allow for average of 25 letters per nameplate.

.5 Identification is to be English.

.6 Lighting panels: Plates shall be mounted on inside of door, typical identification "Lighting Panel 'A' 120/208V, three-phase, four-wire".

.7 Provide neatly typed circuit directories in panelboards to indicate the area or equipment controlled by each branch circuit.

.8 Disconnect switches and starters: Plates shall be mounted externally on switch box cover. Typical identification - "Pump Number 1, 575V, three-phase".

.9 Plates shall be installed after all painting has been completed and shall be secured with self-tapping screws except on the inside of panel doors where gluing will be accepted.

.10 Have the manufacturers' nameplates affixed to each equipment showing the size, name of equipment, serial number and all information usually provided, including voltage, cycle, phase, horsepower, and the name of the manufacturer and their address. Ensure that all stamped, etched or engraved lettering on plates is perfectly legible. Do not paint over nameplates and where apparatus is to be concealed, attach the nameplate in an approved location on the equipment support or frame.

.11 Identify all equipment with the corresponding remote controls

1.17 WIRING IDENTIFICATION

.1 All conductors shall be identifiable by coloured insulation and permanent indelible markers, at every terminal and accessible points throughout its entire run.

.2 Low Voltage Wiring: per manufacturer's standard, i.e., CGE low voltage relay switching system.

.3 Install yellow plastic warning tape, 300mm below grade, above all underground ducts.

.4 Provide permanent, corrosion resistant warning markers, suitable to the local inspection authority, imbedded in the surface of concrete slabs which are directly above high voltage cables and duct banks.

.5 Maintain phase sequence and colour coding throughout.

.6 Colour code to CSA C22.1-Latest Revision.

.7 Use colour coded wires in communication cables, matched throughout system.

.8 Control wiring to have same tag number at both ends.

.9 Provide wire tag and circuit identification in all junction boxes.

1.18 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 10 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	yellow	
up to 600 V	yellow	green
Telephone	green	
Other communication systems	green	blue
Fire alarm	red	
Emergency voice	red	blue
Other security systems	red	Yellow

1.19 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.

1.20 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

1.21 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

1.22 SINGLE LINE ELECTRICAL DIAGRAMS (SLD)

.1 Submit “as-built” SLDs based on Contract drawing to Contract Administrator for review.

.2 Contract Administrator will return a CD of drawings in AutoCad (i.e. .dwg) format to Contractor.

.3 Drawings: A1 size

.4 Provide a framed SLD showing all devices.

.5 Provide a second board mounted SLD (10 mm stiff board) with matte laminated finish for portable reference within the electrical room, hung in a prominent location.

1.23 LOCATION OF OUTLETS AND LIGHT SWITCHES

.1 Figured dimensions govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.

.2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised less than three meters to suit construction and equipment arrangements without additional cost to the Owner, provided that the Contractor is notified prior to the installation of the outlets, or equipment.

.3 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.4 Maintain luminaire locations wherever possible. Notify the Consultant of conflicts with other services.

.5 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.6 Locate light switches on latch side of doors.

1.24 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: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.1 Disconnect switches: 1,400mm.

.2 Emergency lighting unit and associated receptacle to be mounted 2,500mm from finished floor

1.25 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 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers, oil-filled transformers, and switchgear operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.26 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 rigid PVC, sized for free passage of conduit, and protruding 50 mm.

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 Arrange for holes through exterior walls and roof to be flashed and made weatherproof. Co-ordinate with appropriate division.

.4 Provide fire stopping for all penetrations through fire-rated walls.

1.27 INSERT, SLEEVES, FASTENINGS AND SUPPORTS

.1 Provide all necessary inserts, hangers, fastenings, sleeves and curbs for electrical equipment, suspended from or passing through structural walls or floors, to suit the specific location, and as approved by the Contract Administrator.

.2 Cables must be supported using “P” clips instead of tie-wraps.

.3 Sleeves: allow 12 mm clearance over the O.D. of all cables and conduits, 25 mm horizontally and vertically for rectangular openings.

.4 Finish sleeves flush with wall finish (each side) or the ceiling to curb top.

.5 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields, properly sized for the load to be carried.

.6 Secure equipment to poured concrete with expandable inserts, properly sized for the load to be carried.

.7 Secure equipment to hollow masonry walls or suspended ceilings with factory made threaded or toggle type inserts, properly sized for the load to be carried.

1.28 CUTTING, PATCHING AND WELDING

.1 Where installation of equipment by this section requires cutting or patching of new or existing work, the work shall be performed by, and under direction and supervision of, this section. Make good surface finishes to satisfaction of the Contract Administrator.

.2 No cutting or welding of beams, columns or structural surfaces is permitted without approval of the Contract Administrator and all damage to finished or unfinished surfaces shall be made good to the satisfaction of the Contract Administrator.

.3 Pay all costs for cutting and patching resulting from failure to co-ordinate timely installation of electrical inserts, sleeves, etc., into masonry structures.

1.29 FIREPROOFING

.1 Where sleeves or openings are installed in walls, floors, roof or partitions to accommodate raceways, cables or bus duct, provide all necessary seals, fittings, barriers and fire-resistant materials to restore the installation to its original fire rating to the satisfaction of the governing authorities and the Owner’s insurance underwriters. Minimum two (2) hour fire rating.

1.30 SEALING OF WALL AND FLOOR OPENINGS

.1 All conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries shown on the drawings have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations to be sealed.

.4 Arrange for holes through exterior walls and roof to be flashed and made weatherproof. Coordinate with appropriate Division.

1.31 TEMPORARY POWER

.1 The Contractor shall be responsible for all costs associated with servicing the site with temporary power (i.e. Electricity) for the purpose of construction as well as maintaining a site office.

.2 The Contractor shall provide a revenue rated power consumption meter to suit the temporary construction power feed.

.3 The use of permanent electrical system for temporary construction service will be only with written permission of the Consultant.

.4 If Owner's operations will be affected by any power outage required for this work, give adequate notice to the Owner and do not interrupt power until approval has been obtained.

1.32 FIELD QUALITY CONTROL (TESTING)

.1 All electrical equipment must be insulation tested. Provide insulation test reports for manufactured equipment prior to shipment to site, and provide insulation test reports for all equipment and cable installed on site.

.2 Minimum insulation test results to be 1,000 megohms for low voltage equipment.

.3 General

.1 Prior to the Owner's acceptance, all electrical equipment, materials and systems installed shall be subject to an inspection and applicable performance tests supervised by the Contract Administrator to ensure that the operation of the system and components satisfy the requirements of the Contract Documents.

.2 Ensure that the system and its components are ready prior to the inspection and test for acceptance.

.3 Conduct all testing by fully qualified personnel only. Tests requiring initial power energization of a system shall not be made without notification of the Contract Administrator. Tests, checks and the like carried out by or on behalf of the Contractor shall be documented and certified at no additional cost to the Owner. Submit two copies of the test certificates to the Contract Administrator.

.4 Carefully check wiring for each system and/or part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams, description of operation, etc.

.5 Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.

.6 In addition to tests on purely electrical systems, supply the necessary labour and equipment for operational tests required by other Divisions where electrical services are involved and make final adjustments to the electrical controls at no additional cost to the Contract Administrator.

.7 Perform tests on auxiliary or specialized systems with the assistance of the manufacturer's representative. Upon successful conclusion of the tests, obtain a certificate from the manufacturer stating that the system has been installed to their satisfaction and that it is in good working order.

.8 Ensure circuit protection devices such as overcurrent trips, relays and fuses are installed to values and settings as indicated.

.9 Replace at no additional cost all fuses, relays, or other devices destroyed during field quality control (testing).

.10 Supply all instruments, meters and personnel required for the tests.

.11 Clean equipment by vacuum. Clean, wax and polish all new exterior surfaces, check and tighten all electrical connections.

.4 Cable and Wire – 1000 Volt and Below

.1 Limit all tests on cables in this voltage range to insulation resistance measurements using a megger: 500 V instrument for circuits up to 350 V systems; 1000 V instrument for 351-600 V systems.

.2 Record all test results in a log book and submit to the Contract Administrator for reference. Replace or repair all circuits, which do not meet minimum requirements specified in the governing Electrical Safety Code. Measure insulation resistance of the following circuits:

.1 Power and lighting feeders (with equipment disconnected): phase-to-phase, and phase-to-ground.

.2 Control circuits: measure to ground only.

.3 Do not perform megger tests on control circuits containing transistorized or solid-state components.

.4 Where power factor correction equipment is installed, it may be necessary to disconnect the capacitors from the system prior to testing to avoid overvoltage.

.5 Motor Controllers

.1 Resistance measurement checks of bus shall be made phase-to-phase and phase-to-ground.

.2 Check current rating and settings of circuit breakers and fuses. Make appropriate adjustments.

.3 Check overload relay current element rating against motor nameplate full load current rating and install correct size if found to be incorrect.

.6 Motors

.1 Before connecting feeder cables, measure winding insulation of each phase-to-ground and repeat tests, after connecting feeder cable, at source of power. Disconnect power factor capacitors during the tests.

.2 Check motors for proper lubrication and alignment; disconnect couplings and remove belts before carrying out rotation check.

.3 Perform motor rotation check under the supervision of the Owner and the equipment supplier.

1.33 CLEANING

.1 Comply with Section 01740 - Cleaning.

.2 Before energizing any system, inspect and clean all the inside of switchgear, panelboard to ensure that they are free from dust and debris.

.3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

.4 Clean all polished, painted and plated work brightly.

.5 Remove all debris, surplus material and all tools.

1.34 MEASUREMENT AND PAYMENT

.1 Payment for the work outlined in this section is included in the lump sum tender price.

1.35 REFERENCES

.1 CSA C22.2 No. 131 Type TECK 90 Cables.

.2 CSA C22.2 No. 38 Thermoset Insulated Wires and Cables.

.3 CSA C68.3 Power Cables with Thermoset Insulation.

.4 CSA C21.1 600 V Control Cable.

.5 CSA C21.2 300 V Control Cable.

.6 ICEA S-66-524.

.7 All power cables must be CSA approved for application.

1.36 DESIGN REQUIREMENTS

.1 Number and sizes of wires (and associated raceways) indicated are a guide only and are not necessarily the exact number and sizes required. Wire or cable sizes smaller than indicated are not acceptable.

.2 Unless otherwise indicated, every cable run from a source to a load is to include an appropriately sized separate ground wire, and the ground wire properly bonded and grounded. The following designations are used within the specifications and drawings:

.1 All cables designed as “3#, +G-C” infers three conductor cable plus ground conductor, within conduit this may be equivalent to “4#”.

.2 All cables designed in a 3-phase, 3-wire system designated as “4#”, infers three branch conductors and one ground conductor of equal size as branch conductors.

.3 All cables designed in a 3-phase, 4-wire system designated as “4#, +G-C”, infers three branch conductors, one neutral conductor and one ground conductor, within conduit this may be equivalent to “5#”.

.4 All cables designed in a 3-phase, 4-wire system designated as “5#”, infers three branch conductors, one neutral conductor and one ground conductor, all conductors sized as the branch conductors.

.3 Supply spare conductors in control, communication and instrumentation cable circuits as follows:

.1 Two to eight utilized conductors in one conduit or cable: two spare conductors.

.2 Nine or more utilized conductors: 20% or three spare conductors, whichever is greater.

.4 No loose wiring or wire ends are accepted. Use manufacturer recommended connectors when installing cables. Use TECK cable connectors terminated in grounded metal plate for all TECK cable terminations. Grounding and attachment to unistrut not acceptable.

1.37 STORAGE

.1 Cap or seal cable ends to prevent water penetration into cable. Reseal after cutting length of cable.

.2 Cables stored with ends unsealed will be immediately removed from site at contractors cost. At no extra cost to the Owner, replace cables to the satisfaction of the Contract Administrator.

PART 2 PRODUCTS

2.1 ACCEPTED MATERIALS AND EQUIPMENT

.1 Materials and Equipment: CSA approved independent agency accepted by Inspection Authorities for use as installed. Where equipment or material is not approved or certified as indicated, obtain and pay for special acceptance from Inspection Authorities or independent agency accepted by Inspection Authorities.

.2 Standards: Unless otherwise indicated, manufacture to standards of North American Standards Agencies

.3 Factory-assemble control panels and component assemblies.

2.2 SELECT PRODUCTS AND EQUIVALENTS

.1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The Contractor shall be responsible to remove and replace defective products at their expense, and shall be responsible for any resulting delays and associated expenses which result from defective products being rejected. Related materials shall be of the same manufacturer throughout the project.

.2 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Tender except as otherwise provided by the Contract Documents.

.3 The design has been based on the use of the specified product and variances arising from changes to those products will be at the Contractor's expense.

2.3 ALTERNATIVE PRODUCTS

.1 All product substitutions must be approved by the Consultant. Failure to obtain approval from the Consultant will result in the alternative product being rejected, in which case the Contractor shall provide an approved product at no additional cost to the Owner.

.2 The Contractor shall assume full responsibility for ensuring. that when providing alternative products or materials, all space, weight, connections, power and wiring requirements are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts and plans. that may be necessary will be borne by the Contractor.

.3 Suppliers to submit all requests for alternative product approval to the Agency. Submissions must be received by the Agency not less than seven working days prior to the close of tenders. Submissions received after the "Cut-Off" date will not be reviewed.

.4 Approval of an alternate is not intended to change the original specifications unless specifically stated in the addenda. The submitter is responsible for all costs incurred by other trades as well as their own, to install the product/system in accordance with the contract documents.

.5 All submissions to be provided with technical data and whatever pertinent information that may be required by the Agency to evaluate equivalency to the specified product. The responsibility to provide sufficient technical data with respect to submissions will remain solely with those making the submission.

2.4 UNIFORMITY OF MANUFACTURE

.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.

2.5 EQUIPMENT FINISH

.1 Unless otherwise indicated, prepare, shop prime and factory finish electrical equipment by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to Electrical Equipment Manufacturers Association of Canada (EEMAC) Y1-2-1979 unless otherwise specified.

.2 Paint indoor distribution enclosures including switchgears, switchboards, MCC, panelboards, and all cabinets light grey ANSI/ASA 61 to EEMAC 2Y-1-1958 unless otherwise specified.

.2 Apply primer on all items which are to be finished on the job.

.3 Clean and touch up all damaged painted finishes with matching lacquer, or, if required by the Consultant, completely repaint damaged surface.

.4 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.6 ENCLOSURE RATINGS

.1 Enclosure ratings to be as follows unless indicated otherwise in the contract documents:

.1 Indoor and dry locations: National Electrical Manufacturers Association (NEMA) 12 or as noted on drawings.

.2 Below grade, damp or outdoor locations: NEMA 4X, or NEMA 3R, or as noted on drawings.

PART 3 EXECUTION

3.1 EXECUTION

.1 The use of permanent electrical system for temporary construction service shall be only with written permission of the Consultant.

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

.3 Expedite the work as follows:

.1 continuously check and expedite delivery of equipment and materials;

.2 if necessary, inspect at the source of manufacture;

.3 continuously check and expedite the flow of necessary information to and from all parties involved;

.4 inform the Consultant promptly where information is required.

.4 The work of this Division shall be coordinated with other Divisions in such a manner as not to interfere with other work. In areas where the ducts, pipes, wiring and equipment for other sections will be installed in proximity to pipes, wiring and equipment pertaining to this division, co-operate to ensure that all pipes, ducts, wiring and equipment are installed to the best advantage.

.5 Equipment, conduit, installed but not co-ordinated with the work of other trades shall be relocated as directed by the Consultant without extra cost to the Owner.

.6 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance and to function properly to the satisfaction of the Consultant. Install exposed conduit runs parallel and perpendicular to building planes. Install conduit concealed in chases, behind furring, or above ceiling, except in unfinished areas. Install exposed systems neatly and group to present a neat appearance.

END OF SECTION

SECTION 16013
UTILITY REQUIREMENTS

SECTION 16013
UTILITY REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE OF WORK

.1 Coordinate with and pay for the services of the local electrical distribution utility (Hydro One) to provide electrical power to the facility.

1.2 ELECTRICAL UTILITY REQUIREMENTS

.1 Co-ordinate and meet all requirements of the local electrical distribution utility.

.2 Install cable, conduit, duct, protection, and any other necessary equipment to supply power to the facility, as required by the local electrical distribution utility, that are in addition to equipment specified in the contract documents.

.3 Install, or pay to have installed, the incoming utility services to the service entrance equipment provided in the base contract, as required by the load requirements of the pumping station, electrical safety inspector, and the local electrical distribution utility.

.4 Provide the local electrical distribution utility with the required information for the service installation.

.5 Pay all associated connection fees/charges for local electrical distribution utility services.

.6 Local electrical distribution utility contact information is as follows:

1. Hydro One
2. www.hydroone.com
3. Dylan Walt (dylan.walt@hydroone.com)

1.3 MEASUREMENT AND PAYMENT

.1 Payment for the work outlined in this section is included in the lump sum tender price.

PART 2 PRODUCTS

2.1 GENERAL

.1 In order for the local electrical distribution utility to provide service to the site the transfer station load characteristics are required, as well as the following information:

Owner's Name: Township of Minden Hills, Chelsea Cosh (Project Manager).

Contractors Name: T.B.D.

Voltage Supply: 240-120V AC, 1-Phase, 60Hz.

Metered service.

2.2 LANDFILL TRANSFER STATION DEMAND LOAD

.1 Refer to contract drawings for the actual connected load and power demand requirements.

PART 3 EXECUTION

3.1 CONSTRUCTION

.1 Contractor to coordinate with Hydro One for providing installation standards, construction specifications and guides to be followed by contractor to provide utility service to the treatment plant.

.2 The local electrical distribution utility (Hydro One) requirements to be followed including Appendix A & B.

END OF SECTION

SECTION 16050
BASIC ELECTRICAL EQUIPMENT AND MATERIALS

SECTION 16050
BASIC ELECTRICAL EQUIPMENT AND MATERIALS

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This section describes various low voltage (<1000V) electrical equipment that is common to a number of areas and systems.

1.2 SCOPE

.1 Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install all equipment and materials specified herein and on the drawings.

.2 All control panels, local control panels and pushbutton stations indicated on the Electrical Drawings – Elementary Control Diagrams will be supplied, installed and tested under this section.

.3 This section refers to starters and equipment not part of Section 16481 - Variable Frequency Drives.

1.3 RELATED SECTIONS

.1 Section 01330 – Submittal

.2 Section 16010 – Electrical General Requirements

1.4 SHOP DRAWINGS

.1 Submit shop drawing in accordance with Section 01300 – Submittals.

.2 For each control panel and pushbutton station include all layout drawings, terminal blocks, control relays, wire numbering system, panel dimensions, enclosure rating, wiring arrangement, nameplates, etc.

1.5 MEASUREMENT AND PAYMENT

.1 Payment for the work outlined in this section is included in the lump sum tender price.

PART 2 PRODUCTS

2.1 ENCLOSURE RATINGS

.1 Indoor and dry locations: NEMA 12 unless otherwise noted.

.2 Below grade, damp or outdoor locations: NEMA 4X, or NEMA 3R, as noted on drawings.

2.2 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch: size as indicated.

.2 Voltage and Current Ratings: As shown on drawings.

.3 Provision for padlocking in off switch position by three locks.

.4 Mechanically interlocked door to prevent opening when handle is in ON position.

.5 Fuses: size as indicated.

.6 Fuse holders: suitable without adaptors, for type and size of fuse indicated.

.7 Quick-make, quick-break action, non-teasible mechanism with visible blade – dead front construction.

.8 ON-OFF switch position indication on switch enclosure cover.

.9 Early break auxiliary contact (switch), as indicated.

.10 Acceptable manufacturers:

.1 Eaton

.2 Schneider

.3 Siemens

.4 Allen-Bradley

.5 Or approved equivalent.

2.3 DRY TYPE TRANSFORMERS UP TO 600 V PRIMARY

.1 Design

.1 Type: ANN, naturally air-cooled, high efficiency.

.2 Meeting the latest federal, provincial and local efficiency and losses standards.

.3 3 phase, kVA as indicated, 600 V input, 208/120 V output, 60 Hz.

.4 Voltage taps: 2 – 2½% FCAN, 2 – 2½% FCBN, silver plated.

.5 Insulation: Class H, 150°C temperature rise (maximum 220°C insulation class). For 30 kVA or less, 130°C temperature rise (maximum 200°C insulation class).

.6 Windings: copper.

.7 Angular displacement: secondary lagging primary by 30°C, as defined by IEC-DY-1.

.8 Basic Impulse Level (BIL): per CSA standards.

.9 Hipot: standard.

.10 Average sound level: 45-47 dB.

.11 Impedance: standard.

.12 Enclosure: Nema 1 ventilated, removable metal front panel.

.13 Mounting: Wall.

.14 Finish: in accordance with Section 16010 – Electrical General Requirements.

.2 Manufacturer's nameplate to indicate: angular displacement, connection diagram and taps, polarity type, phase, kVA capacity, voltage ratio, frequency, LIL (BIL), impedance, insulation class, insulation and winding material, temperature rise, sound level, weight, serial number, date of manufacture, manufacturer, CSA label, etc.

.3 Acceptable manufacturers are:

.1 Hammond

.2 Polygon-Jefferson

.3 Eaton

.4 Schneider

.5 Marcus

.6 Or approved equivalent.

2.4 POWER AND LIGHTING PANELBOARDS

.1 Panelboards: product of one manufacturer.

.2 208/120 V panel boards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated, whichever is greater.

.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 Two keys for each panel board and key panel boards alike.

.6 Copper buses with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim and door finish in accordance with Section 16010 – Electrical General Requirements.

.9 Base panel boards on CSA C22.2 No. 29 – specification.

.10 Panel board Breakers:

.1 Breakers with thermal and magnetic tripping in panel boards except as indicated otherwise.

.2 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.3 Lock-on devices as indicated.

.4 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.5 Common-trip breakers: with single handle for multi-pole applications.

.6 Ground fault protection circuit breakers: Class A type, 120 V AC, complete with automatic shunt trip, zero sequence transformer and facilities for testing and reset pushbuttons.

.11 Acceptable manufacturers are:

.1 Eaton

.2 Siemens

.3 Schneider

.4 Or approved equivalent.

2.5 MOTOR STARTERS/CONTACTORS

.1 General

.1 Starters: to EEMAC E14-1. Half size starters not acceptable.

.2 Enclosure ratings: suitable for applicable area.

.3 Voltage and Current Ratings: As shown on drawings.

.4 Complete with four (4) spare Form C auxiliary contacts, in addition to those used in the control circuitry, unless indicated otherwise.

.2 Full Voltage Magnetic Starters

.1 Magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type rated heavy duty and long life.

.2 Interchangeable solid-state motor overload protective device in each phase, manually reset from outside enclosure.

.3 Power and control terminals.

.4 Elementary control diagrams as indicated on drawings and located inside starter enclosure in visible location.

.5 Identify each wire and terminal for external connections, within starter, with permanent number marking.

.6 Minimum starter size: EEMAC Size 1.

.2 Magnetic starters to include motor circuit protector (MCP) – magnetic type circuit breaker properly rated for motor, with operating lever on outside of enclosure with provision for:

.1 Locking in “OFF” position with up to 3 padlocks.

.2 Preventing switching to “ON” position while enclosure door open.

.3 Heating/Lighting Contactors

.1 Contactors: to EEMAC No. 1CS latest edition.

.2 Permanent magnet latch type controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Complete with four (4) spare Form C auxiliary contacts, in addition to those used in the control circuitry, unless indicated otherwise.

.4 Contactor to include enclosure, disconnect switch – interlocked with enclosure door, control transformer with primary and secondary fusing, indicating lights, selector switches, pushbuttons, etc.

.4 Ventilation and Air Handler starters

.1 Provide self-contained, full voltage magnetic starters.

.5 Acceptable Manufacturers

.1 Eaton

.2 Allen-Bradley

.3 Schneider

.4 Siemens

.5 Or Agency approved equivalent.

2.6 CONTROL PANELS – NON-HAZARDOUS AREAS

.1 Shop fabricates electrical control panels from prime quality cold rolled 14-gauge steel, properly formed with continuous welded seams and suitably reinforced to provide adequate strength.

.2 Provide doors with continuous stainless steel piano hinges permitting access to all internal components and wiring. Make provision for padlocking the enclosure.

.3 For 575 V and 120 V equipment components a single housing with metal barriers and separate access doors can be employed, provided the installation complies with Electrical Code Inspection Authority regulations.

.4 Control panel enclosure: as per Clause 2.1, constructed with permanently secured oil-resistant neoprene gasket. Mounting and sizing requirements as indicated on drawings.

.5 Control devices: as indicated on contract drawings.

.6 Control panel wiring: minimum #14 AWG, stranded copper, 600 V thermoplastic insulated, moisture resistant (TEW type).

.7 Insulation colours: green-ground, white-neutral, black-phase, red-control.

.8 Control panel finish in accordance with Section 16010 – Electrical General Requirements.

.9 Provide inside terminal mounting board for each panel.

.10 Control terminal blocks: 600 V – 20 A rating, #12 AWG max. wire size. Equal to Weidmuller type SAK2.5N.

.11 Fused terminal blocks: 600 V – 15 A rating, #8 AWG max. wire size, blown-fuse neon indicator, fuse size as indicated. Equal to Weidmuller type SAKS6.

.12 Acceptable Panel manufacturers:

.1 Hammond Manufacturing

.2 Ralston Metal Products Ltd.

.3 Eurobec

.4 Robroy Industries

.5 Or approved equivalent.

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL

.1 Install and/or connect equipment as indicated.

.2 Perform tests in accordance with Section 16010 – Electrical General Requirements and manufacturer's recommendations.

3.2 DISCONNECT SWITCHES

.1 Install disconnect switches complete with fuses as indicated.

.2 Provide all necessary mounting hardware.

.3 Provide disconnect switches – surface mounted on brick, concrete or block walls with 3 mm thick insulated washers between enclosure and wall face.

.4 Mounting height: 1500 mm above finish floor level to top of switch enclosure.

3.3 DRY TYPE TRANSFORMERS UP TO 600 V PRIMARY

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor pad.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

3.4 POWER AND LIGHTING PANELBOARDS

.1 Refer to Section 16480 – Low Voltage Motor Control Centres.

3.5 CONTROL PANEL INSTALLATION AND TESTING

.1 Install all operator control panels according to size and type indicated on the drawings.

.2 Arrange and mount pushbuttons, selector switches, etc. on control panels as indicated on drawings.

.3 Where three or more control devices are mounted in single enclosure, wire them to terminal blocks at the bottom of the enclosure for connection of external wiring. Identify all wiring at each termination point with wiremarkers.

.4 Identify each control panel and each corresponding group of control device with nameplates, with identical wording as indicated on drawings.

.5 Arrange all wiring within the control panel systematically so that all circuits can be readily traced.

.6 Wire runs up to ten conductors may be tie-wrapped. For wiring installations exceeding ten conductors, plastic wire ducts with covers shall be used.

.7 Provide terminal block terminations for all outgoing wiring connections including spare terminals totaling at least 25% of those actually used.

.8 Wiring connections to terminal blocks not to exceed two wires per terminal. Use Bridge Bars if more than two wire connections are required.

.9 Provide all terminals blocks with clear plastic snap-on safety covers.

.10 Install all panels true, plumb and square to build lines, and to mounting height specified in Section 16010 – Electrical General Requirements.

.11 Perform tests in accordance with Section 16010 – Electrical General Requirements.

.12 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.

.13 Where ‘control modules’ are supplied by other divisions for panel mounting, co-ordinate with the appropriate division.

.14 Upon completion of sectional test, undertake group testing.

.15 Check out complete system for operational sequencing.

.16 Submit to Engineer copies of the test results.

3.6 MOTOR STARTERS AND CONTACTORS

.1 Perform tests in accordance with Section 16010 – Electrical General Requirements and manufacturer’s instructions.

.2 Operate switches, starters and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of starters contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Ensure all protective devices ratings and settings are properly coordinated to suit nameplate rating of actual equipment supplied and/or installed.

.6 Manual motor starters nameplate: Refer to Specification 13040

END OF SECTION

SECTION 16051
INSTALLATION OF CABLES IN TRENCH AND DUCTS

SECTION 16051
INSTALLATION OF CABLES IN TRENCH AND DUCTS

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 02315 - Excavating, Trenching and Backfilling

.2 Section 16010 – Electrical General Requirements

1.2 MEASUREMENT AND PAYMENT

.1 Payment for the work outlined in this section is included in the lump sum tender price.

PART 2 PRODUCTS

2.1 MARKERS

.1 Suitable marking tape.

2.2 CABLE PULLING EQUIPMENT

.1 6mm stranded nylon pull rope with tensile strength of 5kN.

PART 3 EXECUTION

3.1 DIRECT BURIAL OF CABLES/DUCTS

.1 After sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Install cables so that they run adjacent to each other, do not cross over each other, and are covered with a layer of 100mm screened sand.

.3 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.4 Make termination and splice only as indicated leaving the specified length of surplus cable in each direction.

.1 Make splices and terminations in accordance with manufacturer’s instructions using approved splicing kits.

.5 Underground cable splices not acceptable.

.6 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, eight times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.7 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

3.2 MARKERS

.1 Install suitable marking tape buried approximately halfway between the installation and grade level.

.2 Where marking tape is removed to permit installation of additional cables, reinstall new marking tape.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 16010 – Electrical General Requirements.

.2 Perform tests using qualified instruments and equipment.

.3 Check phase rotation and identity each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance Tests

.1 After installing 1,000V cable(s) but before terminating, perform megger testing on each phase conductor.

.2 Check insulation resistance after each termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 Megger Testing: Megger test all 1,000V and 600V power cables in accordance with manufacturer's specifications.

.7 Provide the Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

SECTION 16110
CONDUIT AND CABLETRAY SYSTEMS

SECTION 16110
CONDUIT AND CABLETRAY SYSTEMS

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This section describes the requirements for supply and installation of conduit and cable tray systems.

1.2 SCOPE

.1 Contractor to make use of existing tray system unless the existing tray cannot support the additional cable run or the cable becomes de-rated below acceptable levels as per electrical code requirements.

.2 Supply and install all conduits, cable trays, fittings, supports, hangers and miscellaneous support materials and hardware required for the complete systems in accordance with the applicable codes and regulations and as specified herein and on the drawings.

1.3 LOCATION OF CONDUIT

.1 Drawings do not indicate all conduit, cable tray and supporting runs. Those indicated are in diagrammatic form only.

1.4 REFERENCE

.1 Canadian Standards Association:

.1 CSA C22.2 No. 45 Rigid Metal Conduit.

.2 CSA C22.2 No. 56 Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.3 CSA C22.2 No. 211.2 Rigid PVC (Unplasticized) Conduit.

.2 National Electrical Manufacturers Association (NEMA):

.1 RN 1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

.2 TC 2, Electrical Polyvinyl Chloride Plastic Tubing (PVC) and Conduit.

.3 TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.

.4 Electronic Industry Association (EIA) and Telecommunications Industry Association (TIA): 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces

1.5 SUBMITTALS

.1 Contractor to provide a proposed layout drawing of cable tray and conduit network for approval by Client and Consultant.

.2 Layout drawings to include dimensions, sections, and interferences.

.3 Submit shop drawings sealed and signed by a professional engineer licensed in the Province of Ontario and retained by the Contractor certifying that cable trays supports, and anchorage are designed to the requirements of post-disaster facility as per the Ontario Building Code Division B, Part 4, Article 4.1.8.17 for post-disaster structures.

.4 After installation a professional engineer licensed in the Province of Ontario and retained by the Contractor shall complete a Site review and then submit a letter, sealed and signed, stating that the cable trays supports and anchorage are designed and installed to the requirements of post-disaster facility as per the Ontario Building Code Division B, Part 4, Article 4.1.8.17 for post-disaster structures.

PART 2 PRODUCTS

2.1 CONDUITS

.1 Unless otherwise noted, all conduits shall be rigid steel metal threaded conduit, hot dip galvanized inside and outside. Complies with CSA C22.2 No. 45-M1981.

.2 Epoxy coated conduit: with zinc coating and corrosion resistant epoxy finish inside and outside. Use ETL-001 certified Plastibord Redhot by Eaton Crouse-Hinds conduits in wet well for all electrical and control wiring.

.3 Rigid PVC conduit, manufactured to schedule 40 wall thickness. Solvent weld compound for all PVC joints. Complies with CSA C22.2 No. 211.2. For use underground and embedded in concrete.

.4 Liquid-tight flexible metal conduit, spirally wound interlocked armour construction with overall PVC jacket. Complies with CSA C22.2 No.56.

.5 Flexible PVC conduit, as indicated. Complies with CSA C22.2 No. 227.2.

.6 Minimum conduit size: 19 mm.

2.2 CONDUIT FASTENINGS AND SUPPORTS

.1 One-hole and two-hole hot dip galvanized steel straps for metal conduit.

.2 Two holes PVC straps for PVC conduit.

.3 Stainless steel clamps/cleats for wet wells and hot dip galvanized steel beam clamps for non-corrosive areas.

.4 Hot dip galvanized steel channel type supports, U-shape, size 41 x 41 mm, 2.5 mm thick.

.5 6 mm diameter threaded galvanized steel rods to support suspended channels. Provide all necessary galvanized steel spring loaded bolts, nuts, washers and lock washers.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit. Fittings to incorporate nylon insulated throat or bushing.

.2 Factory “ells” where 90 degrees bends are required for 25 mm and larger conduits.

.3 Pressure type terminals for all rigid steel conduit grounding wire connections.

.4 Rigid steel conduit hub type connectors in wet or outdoor areas: nylon insulated with recessed neoprene ‘O’ ring.

.5 Liquid tight flexible conduit fittings to incorporate a threaded grounding core, nylon compression ring and gland. Insulated throat, male thread and locknut or bushing with an integral ‘O’ ring seal.

.6 Locknuts bonding type with sharp edges for digging into metal wall of enclosure.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.2 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 6 mm stranded nylon cord, tensile strength 5 kN.

2.6 CABLE TRAY

.1 Cable tray s and fittings: to EEMAC F5-1.

.2 Ladder type, Class C1 to CSA C22.2 No. 126.

.3 Minimum 300 mm rung spacing.

.4 Aluminum tray, width as indicated with depth of 100 mm, unless otherwise indicated.

.5 Horizontal elbows, end plates, dropouts, vertical risers and drops, tees, wyes, expansion joints and reducers where required. Fittings: manufactured accessories for cable tray supplied. Radii on fittings: 600 mm minimum.

.6 Solid barriers where different voltage systems are in the same cable tray.

.7 Trays for non-armoured cables in plant area to be solid type with solid cover.

.8 Provide galvanized steel rods and U-channels to support the cable tray system.

2.7 MANUFACTURERS

.1 Acceptable rigid steel conduit manufacturers:

.1 Appleton

.2 Crouse-Hinds

.3 Killark

.4 Or approved equivalent

.2 Acceptable rigid PVC conduit manufacturers:

.1 Ocal

.2 Robroy Industries

.3 Or approved equivalent

.3 Acceptable liquid tight and flexible conduit manufacturers:

.1 O-Z/Gedney

.2 Thomas and Betts (T&B)

.3 Or approved equivalent

.4 Acceptable conduit fittings manufacturers:

.1 Appelton

.2 Crouse-Hinds

.3 Killark

.4 Meyers

.5 Or approved equivalent

.5 Acceptable support channel manufacturers:

.1 W.C. Pursley

.2 Pilgrim

.3 Canstrut

.4 Or approved equivalent

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Use rigid galvanized steel threaded conduit except noted on drawings otherwise.

.3 Use rigid PVC conduit underground only, in corrosive areas or as noted on drawings.

.4 Use liquid tight flexible metal conduit for connection to all motors or vibrating equipment.

.5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.6 Mechanically bend steel conduit over 19 mm diameter.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Install fish cord in empty conduits.

.9 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

.11 Support equipment using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.12 Install expansion sleeves wherever conduits cross a structural expansion joint.

.13 Install waterproof conduit system in designated wet areas.

.14 Conduits shall not penetrate the roof of the MCC enclosure.

.15 Extend spare conduits 100 mm into building and/or switchgear enclosure and seal with threaded cap for future use.

3.2 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 mounted 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.

.7 Do not use ‘C’ type clamps or perforated metal straps.

.8 The maximum length of straight conduit run shall be 60 m between pull boxes or other terminations. Reduce this length by 15 m for each 90 degrees bend or 7 m for each 45 degrees bend or offset. Conduit runs to include not more than the equivalent of two 90 degrees bends between pull boxes except where indicated otherwise on the drawings.

.9 Make no holes in building structural members for supporting conduits without the permission of the Contract Administrator.

.10 Touch up and repair coated conduits and fittings on which the epoxy or PVC finish has been damaged; paint with a compound material supplied by the original conduit manufacturer.

.11 Fasten exposed conduit to building construction or support system using straps.

.1 One-hole galvanized steel straps to secure surface conduits 50 mm and smaller.

.2 Two-hole galvanized steel straps for conduits larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.12 Suspended support systems

.1 Support individual conduit runs with 6 mm dia. threaded rods and spring clips.

.2 Support two or more conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.13 For surface mounting of two or more conduits use channels at 1 m o.c. spacing.

.14 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit runs.

3.3 NEW OPENINGS IN EXISTING CONCRETE

.1 Make new holes in existing concrete for piping, conduit, cables, or equipment, using either method described below:

.1 Chip with a hammer and chisel. Adjust the location of holes as necessary to avoid electrical conduits if encountered. Cut reinforcing steel after permission is received.

.2 Core-drill holes after radiograph procedures are followed.

.2 Radiograph the existing concrete in the area of each proposed hole for 3 diameters around the centreline of the proposed penetration. If no structural steel, piping or electrical conduits are found, core the hole. If structural steel, piping or electrical conduits are found, select an alternative location and radiograph it, until a suitable coring location is identified. Include up to three (3) sets of Radiographs in base price.

.3 Prior to commencing work, submit to the Contract Administrator a photocopy of the license issued under the Atomic Energy Control Board Regulations for radiography. Perform work in accordance with current Atomic Energy Control Board Regulations for radiography. Be responsible for boundary controls, signs, etc. that protect the facility personnel and others from hazards in the radiograph work area. Inform the Contract Administrator in writing 48 hours prior to commencing any radiography.

3.4 CABLE TRAYS

.1 Install complete cable tray system.

.2 Support cable tray on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 The tray system to be continuous through walls and floors; provide all vertical sections with removable solid covers for a distance of 3 m above the finished floor level. Seal openings in walls and floors to the original fire rating with fire resistant material after the installation of the trays and cables.

.5 Tray supports spacing: 3 m maximum, unless otherwise indicated. Mechanically bolt all tray connections for jointing or supports.

.6 Make extensions with radial turns, drops or risers.

.7 Fasten vertical cable tray s terminating at equipment enclosures to the top of each enclosure.

.8 Install expansion joint type coupling connectors for all straight tray runs exceeding 30 m.

.9 Install in each tray a #4/0 copper conductor for equipment grounding. Attach the ground conductor to each tray section and fitting with an approved ground clamp. Bond all trays to building ground system at both ends at 15 m intervals. This requirement is for all new trays and for existing trays with new cables that do not have the #4/0 copper conductor in place.

.10 Install barriers where required.

.11 Install cable trays 300mm above HVAC ducts, unless otherwise indicated.

3.5 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 2 m centres, with “P” clips. Tie wraps are not acceptable.

.4 Identify cables every 30 m with Size 2 nameplates in accordance with Section 16010 – Electrical General Requirements.

END OF SECTION

SECTION 16120
WIRES AND CABLES

SECTION 16120
WIRES AND CABLES

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This section describes the main types of wires and cables to be installed in this project, as well as any special installation procedures and precautions.

1.2 REFERENCES

.1 CSA C22.2 No. 131 Type TECK 90 Cables.

.2 CSA C22.2 No. 38 Thermoset Insulated Wires and Cables.

.3 CSA C22.2 No. 174 Cables and Cable Glands for use in Hazardous Locations.

.4 CSA C68.3 Power Cables with Thermoset Insulation.

.5 CSA C21.1 600 V Control Cable.

.6 CSA C21.2 300 V Control Cable.

.7 ICEA S-66-524.

.8 All power cables must be CSA approved for application.

1.3 DESIGN REQUIREMENTS

.1 Number and sizes of wires (and associated raceways) indicated are a guide only and are not necessarily the exact number and sizes required. Wire or cable sizes smaller than indicated are not acceptable.

.2 Unless otherwise indicated, every cable run from a source to a load is to include an appropriately sized separate ground wire, and the ground wire properly bonded and grounded. The following designations are used within the specifications and drawings:

.1 All cables designed as “3#, +G-C” infers three conductor cable plus ground conductor, within conduit this may be equivalent to “4#”.

.2 All cables designed in a 3-phase, 3-wire system designated as “4#”, infers three branch conductors and one ground conductor of equal size as branch conductors.

.3 All cables designed in a 3-phase, 4-wire system designated as “4#, +G-C”, infers three branch conductors, one neutral conductor and one ground conductor, within conduit this may be equivalent to “5#”.

.4 All cables designed in a 3-phase, 4-wire system designated as “5#”, infers three branch conductors, one neutral conductor and one ground conductor, all conductors sized as the branch conductors.

.3 Supply spare conductors in control, communication and instrumentation cable circuits as follows:

.1 Two to eight utilized conductors in one conduit or cable: two spare conductors.

.2 Nine or more utilized conductors: 20% or three spare conductors, whichever is greater.

.4 No loose wiring or wire ends are accepted. Use manufacturer recommended connectors when installing cables. Use TECK cable connectors terminated in grounded metal plate for all TECK cable terminations. Grounding and attachment to unistrut not acceptable.

1.4 STORAGE

.1 Cap or seal cable ends to prevent water penetration into cable. Reseal after cutting length of cable.

.2 Cables stored with ends unsealed will be immediately removed from site at contractor’s cost. At no extra cost to the Owner, replace cables to the satisfaction of the Contract Administrator.

PART 2 PRODUCTS

2.1 MANUFACTURED PRODUCTS

.1 Comply with standards listed in 1.2, References.

.2 Low Voltage Unarmoured Wire and Cable (1000 V and Below)

.1 Construction: Stranded, annealed copper conductors, 600 V minimum rating for conductors #10 AWG and smaller and 1000 V rating for conductors larger than #10 AWG, RW90 cross-linked polyethylene (XLPE) insulation, suitable for handling at minus 40°C ambient, 90°C maximum conductor temperature, limited flame spread FT4, jacketed.

.2 Direct buried installations or installations in direct buried PVC conduit: Cross-linked polyethylene (XLPE), RWU90 insulation, 1000 V minimum rating, jacketed.

.3 Minimum conductor sizes: Unless otherwise indicated, #12 AWG for power and current transformer circuits; #14 AWG for control circuits.

.4 Multi-conductor cables: PVC flame retardant black jacket overall, suitable for handling at minus 40°C, flame test rated FT4.

.5 Lighting wiring: GTF wire, 600 volts, 125°C, flexible copper conductor for connections between luminaire and outlet boxes.

.6 Colour coding: For insulated conductors, conform to the following:

.1 Line and load circuits AC or DC power: Black.

.2 AC control circuits: Red.

.3 DC control circuits: Blue.

.4 Interlock control circuits on the panel energized from external source: Yellow.

.5 DC signal grounding conductors: Green/White Stripes.

.6 Equipment grounding conductors: Green.

.7 Current carrying grounded conductor (neutral): White.

.8 Intrinsically safe: Blue.

.7 Insulated ground conductors forming part of a multi-conductor cable assembly: Inspection Authority colour coding.

.8 Acceptable manufacturers: Phillips Cables Limited, Alcatel Canada Wire Inc., Pirelli Cables Inc., United Wire of Canada. Or Agency approved equivalent.

.3 Low Voltage Armoured Wire and Cable (1000 V and Below)

.1 Construction: Stranded, annealed copper conductors, 1000 V rating, RW90 cross-linked polyethylene (XLPE) insulation, suitable for handling at minus 40°C ambient, 90°C maximum conductor temperature, flame test rated FT4.

.2 Power cabling: TECK construction.

.3 Control cabling: TECK construction.

.4 Hazardous location: HL TECK construction.

.5 Minimum conductor size: Unless otherwise indicated, #12 AWG for power and current transformer circuits and #14 AWG for control.

.6 Grounding conductor: Stranded, soft, bare copper conductor in multiconductor cables, concentric copper wires over insulation in single conductor cable.

.7 Multi-conductor cables: With inner jacket of suitable PVC (minus 40°C).

.8 Interlocking armour: Flexible, galvanized steel or aluminum for multi-conductor cables and aluminum for single conductors, spirally wound over inner jacket.

.9 Outer jacket: PVC (minus 40°C), flame-retardant, FT4 flame test rated, low acid gas evolution, black outer jacket extruded over the armour.

.10 Colour coding: For insulated conductors, conform to the following:

.1 Line and load circuits AC or DC power: Black.

.2 AC control circuits: Red.

.3 DC control circuits: Blue.

.4 Interlock control circuits on the panel energized from external source: Yellow.

.5 DC signal grounding conductors: Green/White Stripes.

.6 Equipment grounding conductors: Green.

.7 Current carrying grounded conductor (neutral): White.

.8 Intrinsically safe: Blue.

.11 Acceptable manufacturers: Phillips Cables Limited, Alcatel Canada Wire Inc., Pirelli Cables Inc., United Wire of Canada, Rome Cable. Or Agency approved equivalent.

.4 Instrumentation Wiring

.1 Conductors: #16 AWG, 7 strand minimum, tinned copper, unless otherwise indicated, 300 V minimum insulation.

.2 Construction: Twisted pair, triplet and quad grouping with nominal 50 mm staggered lay and 100% aluminum-Mylar tape shield with minimum 25% overlap.

.3 Drain wire: Over each group, bare, #20 AWG minimum, tinned copper, in direct continuous contact with shield.

.4 Jacket: PVC (-40°C) low acid gas, FT4 rated low flame spread.

.5 Identification: Each grouping (pair, triplet, quad) by consecutive number coding, permanently marked at 25 mm intervals.

.6 Armour: For exposed or direct buried cables, aluminum or steel interlocking armour with overall PVC jacket.

.7 General purpose instrumentation cable: 16 AWG, Type #9316 by Belden Wire and Cable or Agency approved equivalent.

.8 RS485 cables: 2 pair, 16 AWG stranded copper, separately twisted pairs, overall 100% aluminum-polyester shield, tinned copper stranded drain wire by Belden Wire and Cable or Agency approved equivalent.

.9 Termination fittings: Type, configuration and gender required to connect cable directly to equipment without additional adapters or fittings.

.10 Data highway communication cable: Stranded, tinned copper conductor with aluminum armour and overall PVC jacket, 20 AWG, Type #9463 by Belden Wire and Cable or Agency approved equivalent.

.11 For analog signal wiring, use uniformly twisted shielded pairs not smaller than CSA 0.823 mm^2 (18 AWG) with a minimum of six twists per 300 mm (one foot). Separate analog signal wiring at least 150 mm (six inches) from power wiring. Provide continuous foil or metalized plastic shields with 100 percent coverage. Include a drain wire in continuous contact with the shield. Multiple cables must have an overall shield and individual shields for each signal cable.

.5 Control Wiring

.1 Size and install all wire and cable in accordance with CSA, Ontario Electrical Safety Code, IEEE and other applicable electrical safety codes.

.2 Terminate all internal panel wiring to external devices at the terminal strips. Connect all field wiring to one side of the terminal strip. All panel wiring to be connected to the opposite side. Arrange terminals for external connects in consecutive order for conductors within a given cable.

.3 Use flexible, stranded, copper TEW wiring. Run wires in continuous lengths from terminal to terminal. Do not splice wires.

.4 For analog signal wiring, use uniformly twisted shielded pairs not smaller than CSA 0.823 mm^2 (18 AWG) with a minimum of six twists per 300 mm (one foot). Separate analog signal wiring at least 150 mm (six

inches) from power wiring. Provide continuous foil or metalized plastic shields with 100 percent coverage. Include a drain wire in continuous contact with the shield. Multiple cables must have an overall shield and individual shields for each signal cable.

.5 Use CSA 2.5 mm2 (14 AWG) if approved under the local electrical authority or larger for control signal wiring.

.6 Segregate signal wiring from control power wiring: group functionally and arrange neatly to facilitate tracing of circuits. Arrange wiring, respective terminals and 25% spare in separate mounting rails according to the following categories: 120Vac, 24Vdc signal, 24 Vdc control, communication wiring.

.7 Use plastic wiring wraps to bundle wires, outside of wiring ducts. Securely fasten the bundles to the steel structure at intervals not exceeding 300 mm (12 inches). Each bundle contains 30 conductors maximum. Use Panduit, or equal wiring ducts and size to provide a minimum of 20 percent spare space not less than 5 per terminal block.

.8 Do not intermix signals within the same bundle or duct.

.9 Use twisted unshielded wire for other DC signals and segregate from wire conducting AC signals.

.10 Colour code wiring as follows:

.1 Line and load circuits AC or DC power: Black.

.2 AC control circuits: Red.

.3 DC control circuits: Blue.

.4 Interlock control circuits on the panel energized from external source: Yellow.

.5 DC signal grounding conductors: Green/White Strip.

.6 Equipment grounding conductors: Green.

.7 Current carrying grounded conductor (neutral): White.

.8 Intrinsically safe: Blue.

.11 Use PVC crimped sleeve type wire tag identifications with legible machine printed markings and numbers. Adhesive or taped-on tags are not acceptable.

.6 Wiring Accessories

.1 Wire markers: Plastic slip-on, black letters on white background. Shur-Code by Thomas & Betts Ltd., Z-Type by Wieland Electric Inc. Or Agency approved equivalent.

.2 Cable markers: For cables or conductors greater than 13 mm diameter, strap-on type, semi rigid PVC carrier strip. Type K by Wieland Electric Inc. Or Agency approved equivalent.

.3 Terminal blocks: 600 V, 25 A minimum rating, modular, 35 mm DIN rail mounted, provision for circuit number labelling, individually removable, sized to accommodate conductor size and circuit current. Sak Series by Weidmuller Ltd., UK Series by Phoenix Terminal Blocks Ltd., WK Series by Wieland Electric Inc., Entrelec. Or Agency approved equivalent.

.4 Field wiring terminations: Where screw-type terminal blocks are provided, supply insulated fork tongue terminals. Sta-Kon by Thomas & Betts Ltd., Scotchlok by 3M Canada Inc. Or Agency approved equivalent.

.5 Splice connectors for equipment pigtail, lighting and receptacle circuits: For wire sizes #12 and #10 AWG inclusive, twist-on compression spring type. Wing-Nut by Ideal, Marrette Type II by Marr Electric Ltd. Or Agency approved equivalent.

.6 Moisture and waterproofing: In wet locations, with Liquid Tape by Ideal.

.7 Equipment pig-tail power circuit connections: For wire sizes #8 AWG minimum, split-bolt type, sized to suit number and size of conductors. Servit Type KS by Burndy Inc. Or Agency approved equivalent.

.8 Low voltage (1,000V and lower) motor terminations: Heat shrinkable connection kit, including sleeves, caps and sealant. Type MCK by Raychem Canada Ltd., 3M 5319 Or Agency approved equivalent heat shrinkable connections for motor 150HP and above.

.9 TECK cable connectors in hazardous locations: Approved for application.

.10 TECK cable connectors in wet or outdoor areas: Watertight type.

.11 Electrical insulating tape: Scotch 33+ by 3M Canada Inc. Or Agency approved equivalent.

.12 Cable grips: To accommodate type and geometry of cable supported, single weave, variable mesh design, by Thomas and Betts Ltd., Crouse Hinds, Woodhead Canada Ltd. Or Agency approved equivalent.

PART 3 EXECUTION

3.1 COORDINATION

.1 Prior to installation of wiring, compare Contract Drawings with latest issue of Vendor shop drawings.

.2 Report discrepancies promptly to Contract Administrator.

3.2 INSTALLATION

.1 Provide wires of number and size (including corresponding raceways) required, with spare conductors as indicated. Provide adequate wiring for actual equipment installed.

.2 Provide wire and cable according to the Drawings and electrical system requirements.

.3 Pull cable into conduits and cable trays in accordance with cable manufacturer's recommendations. Use patented cable grips suitable for cable type, or pulling eyes fastened directly onto cable conductors.

.4 Limit pulling tension and minimum bending radii to those recommended by manufacturer.

.5 Prevent damage to cable jackets by utilizing adequate lubricant when pulling cables through ducts and conduits.

.6 Arrange cables in parallel rows on cable trays. Maintain cable spacing by fastening cables, with “P” clips, every 2000 mm minimum on straight horizontal runs and to each rung at bends, including two rungs of adjoining straight sections. Fasten cables on vertical tray runs every 1000 mm maximum.

.7 Connect cables to electrical boxes and equipment enclosures located in wet or sprinkled areas with watertight cable connectors.

.8 Provide cable grips for vertical suspension installations to reduce cable tension at connectors and at cable bends.

.9 Install through wiring in junction and pull boxes having no connection within the box. Leave 150 mm minimum of slack inside box.

.10 Facilitate making of joints and connections by leaving sufficient slack in each conductor at panelboards, outlet boxes and other devices.

.11 Do not connect more than three lighting circuits for three phase panels and two lighting circuits for single phase panels to a common neutral.

.12 Install instrumentation signal and thermocouple extension wires in separate raceways from power and control wiring.

.13 Provide mechanical protection for cables within 1500 mm of the floor in buildings and within 2000 mm above grade outdoors.

.14 Identify each cable by attaching a cable marker at each end, in all intermediate manholes, junction boxes and pull boxes.

.15 Provide cable grips on vertical and horizontal catenary cable suspensions.

.16 Install all pull boxes, junction boxes and similar equipment to allow for equipment and cable access and service.

3.3 UNDERGROUND INSTALLATION

.1 Install direct buried cables in 75mm layers sifted sand, free of rock, stone and other sharp objects, above and below.

.2 Where indicated, protect direct buried cables with 50mm thick concrete protection tiles. Extend protection 50mm minimum on either side of cabling.

.3 Install direct buried cable at depth of 600mm minimum. Where rock is encountered and minimum depth cannot be attained, install cables in concrete encased ducts.

.4 Install in suitably sized concrete encased duct where cables pass under roadway or area subject to vehicular traffic or heavy loads.

3.4 WIRING TERMINATIONS

.1 Insulate equipment pig-tail power circuit connections with wire sizes #8 AWG and larger, with heat shrink sleeving termination kits.

.2 Terminate armoured cables with accepted connectors suitable for application, size and type of cable.

.3 Except where pulling tensions exceed allowable cable limits or where tap connections are required, only install splices in power, control and instrumentation cable runs with written permission of Contract Administrator. Where unavoidable, install splices in junction boxes only.

.4 Make power (1000 V and below), control and instrumentation wiring taps, splices and terminations in junction boxes with labelled terminal blocks, securely fastened to avoid loosening under vibration or normal strain. Terminate lighting circuits and 120 V convenience receptacle circuits with twist on or split-bolt type connectors and insulating tape.

.5 Terminate control, signal and instrumentation circuit conductors, including spares, on terminal blocks. Label terminal blocks with unique alphanumeric designation or as indicated.

.6 Identify each conductor, including spares, by wire markers at each termination. Indicate circuit designation or unique wire number. Identify spare conductors as 'SP1', 'SP2', etc.

3.5 INSPECTION AND TESTING

.1 Cable and Wire - 1000 Volt and Below

.1 Conduct insulation resistance measurements using a "Megger" (500 V instrument for circuit up to 350 V systems, 1000 V instrument for 351-600 V systems).

.2 Record test results in a logbook and submit to Contract Administrator for reference. Replace or repair circuits which do not meet Inspection Authority requirements. With equipment disconnected, measure insulation resistance of the following circuits:

.1 Power, lighting, heater and motor feeders: Phase-to-phase, phase-to-ground.

.2 Control circuits: To ground only.

.3 Do not perform "Megger" tests on equipment containing solid-state components.

.4 Disconnect power factor correction capacitors from system prior to testing.

.2 Instrumentation Wiring

.1 Check continuity of each conductor using ohmmeter or DC buzzer. Megger or120 volt filament lamp testing is not acceptable.

.2 Test thermocouple wiring for continuity and polarity in accordance with manufacturer's recommendations.

3.6 WIRING IDENTIFICATION

.1 Identify wiring with wire markers.

.2 Colour code power, feeder and branch conductors at both ends with coloured plastic tapes. Tapes are not required where conductors are identified by jacket colour. Maintain phase and colour sequence throughout.

.3 Identify each conductor, including spares, with a unique alphanumeric designation to facilitate troubleshooting and maintenance.

.4 Identify RPU wiring at terminal blocks and connection points with RPU terminal (I/O) address numbers.

END OF SECTION

SECTION 16130
ELECTRICAL BOXES

SECTION 16130
ELECTRICAL BOXES

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This section describes the requirements for the various electrical boxes required for splicing, connecting, and pulling conductors and cables.

1.2 SCOPE

.1 Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install all electrical boxes specified herein and on the drawings.

PART 2 PRODUCTS

2.1 ENCLOSURE RATINGS FOR ALL EQUIPMENT LISTED HEREIN

.1 Indoor and dry locations: NEMA/EEMAC 12, unless otherwise noted on drawings.

.2 Below grade, damp, subject to splashing, corrosive or outdoor locations: NEMA/EEMAC 4X, unless otherwise noted on drawings.

2.2 SPLITTERS

.1 Reference: CAN Canadian Standards Association (CSA) C22.2 Number 76-M92.

.2 Galvanize steel enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.3 Main, branch and ground lugs to match required size and number of incoming and outgoing conductors as indicated.

.4 At least three spare terminals on each set of lugs in splitters less than 400A.

.5 Lugs: insulator-copper construction.

.6 Ampacity size as specified on drawings.

2.3 JUNCTION AND PULL BOXES

.1 Reference: CAN CSA C22.2 No. 40-M1989.

.2 Welded galvanize steel construction with screw-on flat covers for surface mounting and captive non-corroding chain.

.3 Covers with neoprene gasket and 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.4 Piano type hinges on boxes larger than 300 x 300 mm.

.5 Junction boxes to be located in convenient accessible locations for maintenance and servicing.

.6 Submersible Junction Boxes:

.1 Submersible junction boxes shall be suitable for TECK cable and conduit termination.

.2 Submersible junction boxes shall have cast iron and cast aluminium construction with minimum protection rating NEMA 6P (IP67 or higher) and be tested to withstand prolonged submersion under a 1.83 meter (6 feet) head of water for 24 hours.

.3 Submersible junction boxes shall be complete with mounting lugs suitable for Class 1, Zone 1 or 2 classified area.

2.4 OUTLET AND CONDUIT BOXES GENERAL

.1 Reference: CAN CSA C22.2 No. 18-M1987.

.2 Size boxes in accordance with CSA C22.1.

.3 102 mm square or larger outlet boxes as required for special devices.

.4 Gang boxes where wiring devices are grouped.

.5 Blank cover plates for boxes without wiring devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.5 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel 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.

.2 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.6 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.7 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 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 MANUFACTURERS

.1 Acceptable manufacturers:

.1 Appleton

.2 Crouse-Hinds

.3 W.C. Pursley

.4 BEL

.5 Stelpro

.6 Pyle National

.7 Taylor

.8 C.E.B.

.9 Or approved equivalent

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Provide equipment identification in accordance with Section 16010 – Electrical General Requirements.

.5 Provide access panels in ceilings where junction and pull boxes are located in spaces not otherwise accessible.

.6 Install boxes to clear all building and mechanical services equipment. Where two or more devices are shown at one location, utilize multi-gang boxes. Supply all outlet boxes with covers or plaster rings as required.

.7 Size all boxes to accommodate the number of conduits, conductors and terminal blocks. Provide junction boxes with 20% spare terminal blocks.

.8 Securely fasten surface-mounted boxes to the building or mounting structure and support independently of the conduits entering the box.

.9 Install junction and pull boxes mounted on brick, concrete or block walls with 3 mm thick lead or nylon washers between box and wall face.

.10 Provide all boxes sized to the Electrical Code requirements, in all conduit raceway systems to limit length of straight conduit runs to 60 m. Reduce this length by 15 m for each 90 degrees bend or 8 m for each 45 degrees bend or offset.

.11 Mark location and size of all pull boxes on the record drawings.

.12 Support boxes independently of connecting conduits.

.13 Fill outlet and conduit boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.14 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.15 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

SECTION 16140
WIRING DEVICES

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 This Section describes the requirements for convenience receptacles and lighting switches.

1.2 RELATED SECTIONS

.1 Section 16010: Electrical General Requirements

1.3 SCOPE

.1 Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install the wiring and control devices specified herein and on the drawings.

1.4 DESIGN REQUIREMENTS

.1 All equipment/devices shall have the proper electrical classification of the area in which they are installed.

PART 2 PRODUCTS

2.1 SWITCHES

.1 20 A, 120 V, single pole, double pole, 3-way, 4-way switches, as required or indicated.

.2 Non-hazardous areas: manually operated general-purpose AC switches. Colour to be advised by Contract Administrator.

.3 Wet, damp, subject to splashing hosing down areas: use weather-proof switches.

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, with silver alloy terminals.

.5 Manually operated general purpose AC switches with following features:

.1 Terminal holes approved for Number 10 American Wire Gauge (AWG) wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.6 All switches shall be illuminated when in the off position.

.7 Switches of one manufacturer throughout project.

.8 Acceptable manufacturers:

.1 Non-Hazardous Areas:

.1 Crouse-Hinds

.2 Arrow Hart

.3 Bryant

.4 Hubbel

.5 Smith & Stone

.6 Or approved equivalent

2.2 MANUAL STARTER

.1 120V, one phase, double pole, manual motor starter.

.2 Non-hazardous areas: manually operated general-purpose single-phase manual starter. Colour to be advised by Consultant.

.3 Wet, damp, subject to splashing hosing down areas: use weather-proof manual starters.

.4 Toggle lever operated fully rated for supplied motors.

.5 Manual starters of one manufacturer throughout project.

.6 Acceptable manufacturers:

.1 Crouse-Hinds

.2 Allen Bradley

.3 Cutler-Hammer

.4 Schneider Electric

.5 Or approved equivalent

2.3 RECEPTACLES

.1 Non-Hazardous areas: General purpose, 15 A-125 V AC rated, CSA type 5-15R configuration, U ground, single or duplex receptacle as indicated on drawings. Colour to be advised by Contract Administrator.

.2 Wet, damp, subject to splashing hosing down areas: use weather-proof receptacles.

.3 Duplex receptacles, CSA type 5-15 R, 125V, 15A, U ground, with following features:

.1 Ivory, brown urea moulded housing.

.2 Suitable for Number 10AWG 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 riveted grounding contacts.

.4 Single receptacles CSA type 5-15 R, 125V, 15A, U ground with following features:

.1 Ivory, brown urea molded housing.

.2 Suitable for Number 10 AWG for back and side wiring.

.3 Four back wired entrances, two-side wiring screws.

.5 Receptacles to be sized according to related lighting panel branch circuit breaker.

.6 Other receptacles with ampacity and voltage as indicated.

.7 Receptacles shall be of one manufacturer throughout project.

.8 Acceptable manufacturers:

.1 Non-Hazardous Areas:

.1 Crouse-Hinds

.2 Arrow Hart

.3 Bryant

.4 Hubbel

.5 Smith & Stone

.6 Or approved equivalent

2.4 GROUND FAULT INTERRUPTING RECEPTACLES

.1 Receptacle; CSA 5-15R configuration, 125 V, 15 A, Class A type interrupter.

.2 Integral solid state ground sensing device.

.3 Integral “test” and “reset” pushbuttons.

.4 Duplex, CSA type 5-15R.

.5 Acceptable manufacturers:

.1 Crouse-Hinds

.2 Federal Pioneer

.3 Leviton

.4 Hubbel

.5 Bryant

.6 Or approved equivalent

2.5 COVER PLATES

.1 Cover plates for wiring devices.

.2 Cover plates shall be from one manufacturer throughout project.

.3 Provide brushed stainless steel cover plates for all switched and receptacles unless otherwise indicated.

.4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles or switches as indicated.

.5 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

PART 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 specified in Section 16010 – Electrical General Requirements or as indicated.

.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 specified in Section 16010 – Electrical General Requirements or as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover Plates

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

END OF SECTION

SECTION 16170
AC INDUCTION MOTORS

SECTION 16170
AC INDUCTION MOTORS

PART 1 GENERAL

1.1 GENERAL

.1 Refer to all other Divisions of the Specifications and these documents to determine their effect upon the work of this section.

.2 Products installed, but not supplied under work of this section: Motors and power factor correction capacitors supplied together with driven equipment as package. Refer to driven equipment specifications.

1.2 RELATED SECTIONS

.1 Section 01330 – Submittal

.2 Section 01750 – Spare Parts & Maintenance Material

.3 Section 16010 – Electrical General Requirements

1.3 REFERENCES

.1 The following is a list of standards which may be referenced in this section:

.1 CSA C22.2 No. 100, Motors and Generators.

.2 CSA C390, Energy Efficiency Test Methods for Three-Phase Induction Motors.

.3 American Bearing Manufacturers Association (ABMA):

.1 9, Load Ratings and Fatigue Life for Ball Bearings.

.2 11, Load Ratings and Fatigue Life for Roller Bearings.

.4 American National Standards Institute (ANSI): C50.41, Polyphase Induction Motors for Power Generating Stations.

.5 Institute of Electrical and Electronics Engineers, Inc. (IEEE):

.1 85, Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery.

.2 112, Standard Test Procedures for Polyphase Induction Motors and Generators.

.3 114, Standard Test Procedures for Single-Phase Induction Motors.

.4 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Motors.

.6 National Electrical Manufacturers Association (NEMA):

.1 MG 1, Motors and Generators.

.2 MG 13, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.

.3 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

.7 Ontario Electrical Safety Code Latest edition

.8 Underwriters Laboratories (ULc):

.1 1, Flexible Metal Conduit.

.2 2111, Overheating Protection for Motors.

.9 EEMAC Standard M1-6, Motors and Generators.

.10 EEMAC Standard MG2, Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.

1.4 DEFINITIONS

.1 ODP: Open drip-proof enclosure.

.2 TEFC: Totally enclosed, fan cooled enclosure.

.3 TENV: Totally enclosed, nonventilated enclosure.

.4 Motor Nameplate Horsepower: That rating after any derating required allowing for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

1.5 QUALITY ASSURANCE

.1 Conduct tests by methods detailed in IEEE 112 for three phase motors and IEEE 114 for single phase motors.

.2 Unless noted otherwise, prior to shipment from motor manufacturer’s factory, subject motors to routine tests as defined by EEMAC MG1-12.

.3 Perform tests at motor full speed and at each intermediate speed for multi-speed motors.

.4 Statically and dynamically balance motors over 0-125% speed range.

1.6 SUBMITTALS

.1 Comply with all submittals requirements as specified under Section 01300 Submittals.

.2 Submit the following shop drawings, information and data:

.1 Efficiency and power factor at 1/2, 3/4 and full load.

.2 Approximate outline dimensions of each motor, showing sizes and location of terminal boxes and horizontal and vertical clearances necessary for maintenance purposes.

.3 Total weight and heaviest shipping weight of motor.

.4 Design information regarding shaft and sheave sizes for coordination with driven equipment.

.5 Outline dimensions and technical data for auxiliary equipment, such as surge capacitors and arresters.

.6 Permissible number of fully loaded and unloaded starts over a defined time period (e.g. starts per hour).

.7 Descriptive information.

.8 Nameplate data in accordance with NEMA MG 1.

.9 Additional Rating Information:

.1 Service factor.

.2 Locked rotor current.

.3 No load current.

.4 Safe stall time for motors.

.5 Guaranteed minimum full load efficiency and power factor.

.3 Manuals

.1 Submit bound and indexed copies of operating and maintenance manuals including, but not limited to, the following:

.1 Storage instructions

.2 Certified factory test reports for motor 400kW and larger

.3 Manufacturer’s Certificate of Proper Installation

.4 Complete parts list

.5 Completed data sheet for each motor

.6 Installation instructions

.7 Operating instructions

.8 Maintenance instructions

.2 Factory or Field test results

1.7 DESIGN REQUIREMENTS

.1 Fixed speed, three lead, single-voltage, squirrel-cage induction motors to be designed for full voltage starting unless otherwise indicated.

.2 Design motors and individual components thereof to perform at full nameplate rating in ambient conditions specified. Motor output power to meet operating conditions without infringing upon motor service factor rating.

.3 Comply with standards listed in 1.1, References.

.4 Refer to related driven equipment specification to determine additional motor design requirements with respect to overall system (motor, driven equipment, and auxiliaries) performance parameters, such as driven load characteristics, vibration, noise, operating environment and complete system factory tests.

.5 Unless otherwise noted, motor power rating indicated represents a minimum nominal rating. Consult related driven equipment manufacturer for exact requirements and supply a higher base rating (without service factor multiplier) if necessary to meet equipment operational requirements.

.6 Efficiency: For motors rated 0.746 to 375 kW, at motor full load, meet or exceed minimum quoted efficiency as defined in Supplemental Table 1, measured in accordance with CSA C390.

.7 Power Factor: The motor is to meet or exceed the following % Guarantee Minimum Full Load Power Factor: 88.3.

.8 Unless noted otherwise, design for the following voltages and characteristics:

.1 115 V/208V, single phase, 60 Hz - for motors 0.37 kW and below

.9 Utilize a design B squirrel cage induction motor, provided that this design meets starting and operating requirements of equipment. Minimum starting and breakdown torque as indicated in EEMAC MG1. If larger load torque or WK^2 requirements are encountered, other motor design type selection is acceptable subject to prior acceptance by Engineer.

.10 Motors to operate continuously at rated load without exceeding maximum temperature rise above ambient temperature as indicated.

.11 Size pump motors for duty point conditions without including service factor.

.12 Service Factor: 1.15 minimum at rated ambient temperature.

.13 Power supply variations: At full speed, a combination of ±10% voltage variation, 2% phase voltage imbalance and continuous operation at rated load in specified ambient is not to raise winding hot-spot temperature beyond insulation class rating.

.14 Unless otherwise indicated, design motor for a minimum number of hot starts per hour as determined by driven equipment manufacturer, but not less than two.

.15 Multi-speed motors: Same minimum EEMAC torques for a given EEMAC design, power rating and speed as for single-speed motors.

.16 Do not exceed the maximum locked rotor current values as listed in EEMAC Standard MG1 for the specified EEMAC design and rating.

.17 Pulsating motor currents: Full load and peak current variations to comply with EEMAC MGI-20.82.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Motors for all applications:

.1 GE Canada

.2 US Electrical Motors

.3 Westinghouse

.4 Toshiba

.5 Baldor Motors

.6 Or approved equivalent

2.2 GENERAL

.1 For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

.2 Meet requirements of NEMA MG 1.

.3 Frame assignments in accordance with NEMA MG 13.

.4 Motors to be specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.

.5 Operating Conditions:

.1 Maximum ambient temperature not greater than 40 degrees C.

.2 Motors to be suitable for operating conditions without any reduction being required in the nameplate rated horsepower or exceeding the rated temperature rise.

.3 Over-speed in either direction in accordance with NEMA MG 1.

2.3 HORSEPOWER RATING

.1 As designated in motor-driven equipment specifications.

.2 Constant Speed Applications: Brake horsepower of the driven equipment **at any operating condition** not to exceed motor nameplate horsepower rating, excluding any service factor.

2.4 SERVICE FACTOR

.1 1.15 minimum at rated ambient temperature, unless otherwise indicated.

2.5 EFFICIENCY AND POWER FACTOR

.1 For all motors except single-phase, under 0.75 kW:

.1 Efficiency:

.1 Tested in accordance with CSA C390, paragraph 12.59.

.2 Guaranteed minimum at full load in accordance with NEMA MG 1 Table 1,or as indicated in motor-driven equipment specifications.

.2 Power Factor: Guaranteed minimum at full load in accordance with Table 1 or as indicated in motor-driven equipment specifications.

2.6 ENCLOSURES

.1 Frames: EEMAC standard regarding frame/horsepower relationships for single speed applications.

.2 Type: Totally enclosed, fan cooled (TEFC) unless otherwise indicated with moisture trap, drain or other anti-condensation device and breather plug to prevent entry of foreign material.

.3 Type: Open type motors: Drip-proof, ventilation openings fully guarded with screens of corrosion resistant material.

.4 Materials: Cast iron for motors 75 kW maximum. Aluminum housings or end bells not acceptable.

.5 Corrosion prevention: Internal parts of motor exposed to external cooling air, such as air deflectors and fans, of corrosion resistant material or corrosion resistant plating. Mounting hardware of corrosion resistant material.

.6 Mounting: Unless otherwise indicated, foot mounted suitable for horizontal installation.

.7 Bases: EEMAC dimensions. Adjustable sliding type for belt or chain-drive applications.

2.7 TERMINAL (CONDUIT) BOXES

.1 Oversize main terminal boxes for all motors.

.2 Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.

.3 Except ODP, furnish gaskets between box halves and between box and motor frame.

.4 Waterproof, cast iron or heavy wall steel.

.5 Terminal box location: On right hand side when viewed from the non-driving end, unless otherwise indicated.

.6 Motor lead terminations: Solderless type for incoming cable connections and clamp terminal for ground connections. Clearly and permanently mark motor leads.

.7 Frame to terminal box cable passage: Seal to prevent the entrance of moisture or foreign matter.

.8 Gaskets: Between cover and box mating surfaces.

.9 Ancillary devices: Separate termination box. Clearly identify leads. Supply nameplate data and connection wiring diagrams.

2.8 PAINTING

.1 Finish: Non-machined metal surfaces, one coat, primer and one coat suitable corrosion and oil resistant paint. Colour, manufacturer standard, unless otherwise indicated.

.2 Shipping protection: Including machined surfaces, protect with suitable means to prevent corrosion or moisture accumulation and damage during shipment and installation.

2.9 NAMEPLATE

.1 Nameplates: Stainless steel or non-corrodible alloy, embossed lettering, fixed to non-removable part of frame, in easily readable location, showing standard EEMAC markings, and in addition:

.1 Service factor

.2 Make, type, size of bearings and recommended lubricant

.2 Multi-speed motors: Nameplate information showing wiring diagram and connection for each voltage and/or speed.

2.10 STATOR

.1 Windings and terminal leads: Copper conductors, with ends brought into terminal box.

.2 Insulation: Moisture proof, class F minimum unless otherwise indicated.

.3 Winding temperature detection: Refer to special features and accessories.

.4 For submersible motors, provide a combined leak and temperature detection system (includes detectors and a safety relay with light and Reset push button)

2.11 ROTOR ASSEMBLY

.1 Rotation: For motors designed for single direction operation only, clearly indicate direction of rotation by means of arrow on non-driving end. Painted arrows are not acceptable.

.2 Shaft extensions: With keys.

.3 Keyway: EEMAC standards for EEMAC frame motors.

2.12 BEARINGS AND LUBRICATION

.1 Horizontal Motors:

.1 0.5 kW and Smaller: Permanently lubricated and sealed ball bearings, or regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.

.2 0.75 kW Through 295 kW: Regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.

.3 Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in ABMA 9 and 11.

.2 Oil Lubrication Systems:

.1 Oil reservoirs with sight level gauge.

.2 Oil fill and drain openings with opening plugs.

.3 Provisions for necessary oil circulation and cooling.

.3 Bearing Isolation: Motors rated for inverter duty to have electrically isolated bearings to prevent stray current damage.

2.13 SPECIAL FEATURES AND ACCESSORIES

.1 Screen Over Air Openings: Corrosion-resistant meeting requirements for Guarded Machine in NEMA MG 1 and attached with stainless steel screws.

.2 Winding Thermal Protection:

.1 Thermostats:

.1 Motors for constant speed application 0.75 kW through 50 kW.

.2 Bi-metal disk or rod type thermostats embedded in stator windings.

.3 Automatic reset contacts rated 120 volts ac, 5 amps minimum, opening on excessive temperature. (Manual reset to be provided at motor controller.)

2.14 SPARE PARTS AND SPECIAL TOOLS

.1 As recommended by Manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

.1 In accordance with manufacturer’s instructions and recommendations.

.2 Protect motor against physical damage and moisture until ready for energization.

.3 Dry out motor in accordance with manufacturer's recommendations if dampness present.

.4 Make electrical connections as indicated. Install liquid-tight PVC jacketed flexible conduit section between rigid conduit feed and motor where applicable.

.5 Where applicable, make flexible conduit or armoured cable long enough to permit movement of motor over entire length of slide rails.

.6 Align motor carefully and properly with driven equipment.

.7 Secure equipment to mounting surface with anchor bolts.

.8 Coordinate with trade installing driven equipment in the alignment and coupling of motor to driven machinery. Conform to the manufacturer's instructions and ensure use of correct parts such as couplings, belts, sheaves, as provided by motor manufacturer.

3.2 TESTS

.1 Review installation methods prior to energizing motor.

.2 Before connecting feeder cable, measure winding insulation resistance between each phase and ground. Repeat tests after connecting feeder cable at supply.

.3 Witness final tests and provide certification that the complete installation of the motor, both mechanically and electrically, is per manufacturer's recommendations.

.4 Record results and include in Installation, Operations and Maintenance manual.

.5 Verify operation and settings of motor protection system before energization.

.6 Check motor lubrication, alignment and direction of rotation.

.7 Perform motor rotation check under the supervision of the Engineer and the driven equipment supplier

.8 Conduct additional tests as detailed in Section 16010 and Section 01800.

3.3 MANUFACTURER'S SERVICES

.1 Manufacturer's Certificate of Proper Installation.

4.1 TABLE 1 – MOTOR PERFORMANCE REQUIREMENTS

TABLE 1 MOTOR PERFORMANCE REQUIREMENTS									
		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
1	1,800	82.5	82.5			Mfr. Std.	Mfr. Std.		
	1,200	80.0	80.0			Mfr. Std.	Mfr. Std.		
1.5	3,600	82.5	82.5			Mfr. Std.	Mfr. Std.		
	1,800	84.0	84.0			Mfr. Std.	Mfr. Std.		
	1,200	84.0	85.5		82.0	Mfr. Std.	Mfr. Std.		Mfr. Std.
2	3,600	84.0	84.0			Mfr. Std.	Mfr. Std.		
	1,800	84.0	84.0			Mfr. Std.	Mfr. Std.		
	1,200	85.5	86.5	83.7	83.7	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	82.9	82.5	82.9	81.7	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
3	3,600	84.0	85.5	82.0	82.0	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	86.5	87.5	84.8	84.8	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	86.5	87.5	87.5	86.6	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	84.1	83.0	84.1	82.9	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.

TABLE 1 MOTOR PERFORMANCE REQUIREMENTS									
		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
5	3,600	85.5	87.5	84.8	84.8	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	87.5	87.5	84.8	84.8	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	87.5	87.5	87.5	86.6	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	87.5	85.5	87.5	86.6	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
7.5	3,600	87.5	88.5	84.8	86.6	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	88.5	89.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	88.5	89.5	88.4	87.5	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	87.5	85.5	87.5	86.6	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
10	3,600	88.5	89.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	89.5	89.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	90.2	89.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	89.3	88.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.

TABLE 1 MOTOR PERFORMANCE REQUIREMENTS									
		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
15	3,600	89.5	90.2	88.4	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	91.0	91.0	90.9	90.2	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	90.2	90.2	90.2	89.3	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	89.3	88.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
20	3,600	90.2	90.2	90.9	89.3	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	91.0	91.0	91.7	90.9	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	91.0	90.2	90.2	89.3	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	90.2	89.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
25	3,600	91.0	91.0	91.7	90.2	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	91.7	92.4	92.4	91.7	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	91.7	91.7	90.9	89.3	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	90.2	89.5	89.3	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
30	3,600	91.0	91.0	89.5	88.4	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,800	92.4	92.4	92.4	91.7	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	1,200	92.4	91.7	91.7	90.2	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.
	900	91.7	91.0	90.9	90.9	Mfr. Std.	Mfr. Std.	Mfr. Std.	Mfr. Std.

TABLE 1 MOTOR PERFORMANCE REQUIREMENTS									
		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
40	3,600	91.7	91.7	90.2	89.3	86.6	86.1	87.0	89.0
	1,800	93.0	93.0	92.8	91.7	78.2	78.2	83.0	84.5
	1,200	93.0	93.0	91.7	90.9	81.5	81.5	81.5	81.5
	900	91.7	91.0	90.9	90.2	70.0	70.5	70.0	70.5
50	3,600	92.4	92.4	90.2	89.3	85.1	86.7	89.0	89.0
	1,800	93.0	93.0	92.8	91.7	79.5	79.4	82.5	82.5
	1,200	93.0	93.0	91.7	90.9	81.5	81.5	81.5	81.5
	900	91.7	91.7	90.9	90.9	78.5	72.9	78.5	80.0
60	3,600	93.0	93.0	91.7	90.9	85.8	88.3	87.5	89.0
	1,800	93.6	93.6	93.5	92.8	80.5	79.9	80.5	80.5
	1,200	93.6	93.6	92.8	91.7	81.5	81.5	81.5	81.5
	900	92.4	91.7	91.7	90.9	79.5	73.2	79.5	79.5
75	3,600	93.0	93.0	91.7	91.7	87.1	88.5	88.5	88.5
	1,800	94.1	94.1	93.5	93.5	81.0	81.5	81.0	81.5
	1,200	93.6	93.6	93.5	92.8	82.0	82.0	82.0	82.0
	900	92.8	92.4	92.8	91.7	80.5	74.5	80.5	81.0
100	3,600	93.0	93.6	91.7	91.7	87.0	88.2	87.0	88.5
	1,800	94.1	94.5	94.0	93.5	81.0	81.0	81.0	81.0
	1,200	94.1	94.1	92.8	92.8	82.1	81.7	85.5	85.5
	900	93.5	92.4	92.8	91.7	77.0	77.3	77.0	80.0
125	3,600	93.6	94.5	91.7	91.7	86.4	89.1	87.0	90.5
	1,800	94.5	94.5	93.5	92.8	85.4	85.5	87.5	86.0
	1,200	94.1	94.1	93.5	92.8	82.7	82.3	85.5	85.5
	900	93.5	93.0	92.8	92.4	78.5	78.5	78.5	78.5
150	3,600	93.6	94.5	92.4	91.7	86.5	90.0	86.5	90.5
	1,800	95.0	95.0	94.5	94.0	82.5	85.0	84.5	85.0
	1,200	94.5	95.0	93.5	94.0	81.5	81.5	81.5	81.5

TABLE 1 MOTOR PERFORMANCE REQUIREMENTS									
		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
	900	93.5	93.0	92.8	92.4	78.0	78.5	78.0	78.5
200	3,600	94.5	95.0	92.4	93.0	87.8	89.4	91.0	91.0
	1,800	95.0	95.0	94.0	94.0	85.2	86.5	87.0	87.0
	1,200	94.5	95.0	93.5	93.5	79.0	82.5	79.0	82.5
250	3,600	95.0	95.0	91.7	92.4	85.0	86.5	85.0	86.5
	1,800	96.0	96.0	94.5	94.5	79.0	79.0	79.0	79.0
	1,200	95.0	95.0	94.5	93.5	82.0	82.0	82.0	82.0
300	3,600	95.0	95.0			89.8	89.9		
	1,800	95.4	95.2	94.5	94.0	80.0	80.0	80.0	80.0
	1,200	95.0	95.0			84.5	90.1		
350	3,600	95.0	95.0			89.4	85.9		
	1,800	95.0	95.0			85.9	85.9		
400	3,600	95.0	95.0			88.4			
	1,800	95.0	95.0			86.8			
450	3,600	95.0	95.0			89.1			
500	3,600	95.0	95.0			88.3			

END OF SECTION

SECTION 16450
GROUNDING

SECTION 16450
GROUNDING

PART 1 GENERAL

1.1 INTENT OF SECTION

.1 Supply and install a complete new neutral grounding system for medium voltage power distribution system incoming line and a complete neutral solidly grounding system for downstream 600V power distribution system. Securely and adequately ground all components of the electrical systems in accordance with the requirements of all related sections in the latest Electrical Code and the Inspection Authority.

.2 The works to be done under this section shall include supply of materials and equipment required for installation, furnishing of labour, testing, and putting into proper operation complete electrical systems as specified and as otherwise required. Complete systems shall be left ready for continuous and satisfactory operations.

.3 The grounding systems to consist of ground mats, ground grid, cables, ground rods and conductors, supports and all necessary materials and inter-connections to provide a complete system.

1.2 RELATED SECTIONS

.1 Section 16010 - Electrical General Requirements.

1.3 CODES AND STANDARDS

.1 Provided equipment in accordance with the requirements listed in this specification and the following codes and standards:

.1 Ontario Electrical Safety Code – Latest Edition.

.2 CSA C22.2 No.0.4, Bonding and Grounding of Electrical Equipment (Protective Grounding).

.3 CSA C22.2 No. 41 Grounding and Bonding Equipment.

.4 IEEE No. 80 IEEE Guide for Safety in AC Substation Grounding.

.5 IEEE No. 837 IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.6 IEEE No.32 Standard Requirements, Terminology, and Test Procedure for Neutral Grounding Devices.

.2 Equipment assemblies that do not have CSA and/or ESA approval shall require special CSA and/or Electrical Safety Authority approval applied at the factory and all such costs for inspections and modifications for compliance shall be included.

1.4 SUBMITTALS

.1 Provided manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.5 DELIVERY, STORAGE AND HANDLING

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

PART 2 PRODUCTS

2.1 GROUND ROD

.1 Rod electrodes: copper clad steel, 19 mm dia by 3 m long.

.2 Plate electrode: copper surface area 2 m^2, 2 mm thick.

2.2 CONNECTORS

.1 Exothermic Weld Type:

.1 Outdoor Weld: Suitable for exposure to elements or direct burial.

.2 Indoor Weld: Utilize low-smoke, low-emission process.

.3 Manufacturers:

.1 Thomas & Betts Co.

.2 Compression Type:

.1 Compress-deforming type; wrought copper extrusion material.

.2 Single indentation for conductors 6 AWG and smaller.

.3 Double indentation with extended barrel for conductors 4 AWG and larger.

.4 Barrels prefilled with oxide-inhibiting and antiseizing compound and sealed.

.5 Manufacturers:

.1 Thomas and Betts Co.

.3 Mechanical Type: Split-bolt, saddle, or cone screw type; copper alloy material.

.1 Manufacturers:

.1 Thomas and Betts Co.

2.3 GROUNDING WELLS

.1 Ground rod box complete with cast iron riser ring and traffic cover marked “GROUND ROD”.

.2 Ground rod box: galvanized steel construction, 250 mm diameter x 300 mm deep, 14 gauge (min.), open bottom with removable lid cover.

.3 Manufacturers and Products:

.1 Thomas and Betts Co.

2.4 GROUND BUS

.1 Ground bus to be copper bus, 50 mm x 7 mm.

.2 Support by insulated bushings 25 mm from wall, 300 mm above finished floor.

2.5 GROUND CONDUCTOR

.1 Copper conductor minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.

.2 System and circuit, equipment, grounding conductors: bare stranded copper, soft annealed, size #4/0 AWG.

.3 Insulated grounding conductors: green, type RW90, rated 1000 V, copper conductor.

2.6 GROUNDING ACCESSORIES

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bonding jumpers, straps.

.4 Ground electrode box: galvanized steel construction, 250 mm diameter x 300 mm deep, 14 gauge (min.), open bottom with removable lid cover.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, and to conform to requirements of Engineer, and local inspection authorities having jurisdiction over installation.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or mechanical compression connectors utilizing hydraulic tools.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 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.

.8 Install a minimum of one ground electrode box. Locate box where mechanical damage is avoided and accessible for inspection.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel. Locate connections where they will not be subject to mechanical damage and, where possible, be accessible for inspection.

.11 Where welding to building steel is prohibited or impractical, bolt the ground connection directly to the steel using pressure connectors and 9 mm diameter silicon bronze alloy bolts. Peen the bolts ends after installation. Drilled holes not to exceed 12 mm diameters.

.12 Make connections to ground bus using mechanical clamp type connectors.

.13 Clean surfaces to which ground conductors or bus are bolted to surfaces of paint, rust, etc., and lightly coat both contact surfaces with an oxide-preventing agent before bolting connection to steel member.

.14 For areas requiring multiple connections, such as electrical rooms, attach copper ground loops to building steel or ground bus to which the multiple ground connection shall be made.

.15 Protect ground conductors or bus subject to mechanical damage by rigid galvanized steel conduit or steel guards which shall be effectively grounded at both ends to the ground conductor they are protecting, regardless of length.

.16 Terminate ground wires forming an integral part of cables to equipment ground stud of enclosure at all terminations unless otherwise noted for single cables. Where stud is not provided, drill enclosure housing and install ground fitting.

.17 Ground cable armouring, unless otherwise noted for single conductor cables, at both ends through a ground strip and suitable fittings.

.18 Ground cable shieldings at both ends unless otherwise specified. For high voltage cable, make ground connections through stress cones to ground stud or ground bus.

.19 Connect instrumentation cabling drain wires to ground at one end (receiver) only. Where two or more drain wires are supplied in one cable, bond the wires together.

.20 Shielded Instrumentation Cables: Ground shields at each splice or termination in accordance with recommendations of splice or termination manufacturer.

.21 Shielded Control Cables:

.1 Ground shield to ground bus at power supply for analog signal.

.2 Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.

.22 Do not ground instrumentation cable shield at more than one point.

.23 Install ground conductors passing through masonry walls, floors, foundations, etc., in rigid PVC conduit sleeves. Where sleeves are installed in walls or floors below grade, seal the sleeves watertight after installation of ground conductor.

.24 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.25 Ground secondary service pedestals.

3.2 MANHOLES

.1 Install ground rods outside of each manhole as indicated. Provide with AMP wedge type connector by which grounding connection can be made.

.2 Install size #4/0 AWG stranded copper conductor outside each manhole, and leave 3 meters of copper conductor inside of manholes as indicated.

3.3 ELECTRODES

.1 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.2 Install rod electrodes and make grounding connections.

.3 Bond separate, multiple electrodes together.

.4 Use size #4/0 AWG copper conductors for connections to electrodes.

.5 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails.

3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 120/208 V systems.

3.5 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, frames of motors, motor control centres, starters, all control panels, building steel work, generators, distribution panels, outdoor lighting.

3.6 WIRE CONNECTIONS

.1 Ground Conductors: Install in conduit containing power conductors and control circuits above 50 volts.

.2 Nonmetallic Raceways and Flexible Tubing: Install equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

.3 Connect ground conductors to raceway grounding bushings.

.4 Extend and connect ground conductors to ground bus in all equipment containing a ground bus.

.5 Connect enclosure of equipment containing ground bus to that bus.

.6 Bolt connections to equipment ground bus.

.7 Bond grounding conductors to metallic enclosures at each end, and to intermediate metallic enclosures.

.8 Junction Boxes: Furnish materials and connect to equipment grounding system with grounding clips mounted directly on box, or with 9.5 mm machine screws.

3.7 MOTOR GROUNDING

.1 Extend equipment ground bus via grounding conductor installed in motor feeder raceway; connect to motor frame.

.2 Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

.3 Motors Less Than 10 Hp: Furnish compression, spade-type terminal connected to conduit box mounting screw.

.4 Motors 10 Hp and Above: Tap motor frame or equipment housing; furnish compression, one-hole, lug type terminal connected with minimum 5/16-inch brass threaded stud with bolt and washer.

.5 Circuits 20 Amps or Above: Tap motor frame or equipment housing; install solderless terminal with minimum 8 mm diameter bolt.

3.8 CONNECTIONS

.1 General:

.1 Abovegrade Connections: Install exothermic weld, mechanical, or compression-type connectors; or brazing.

.2 Belowgrade Connections: Install exothermic weld or compression type connectors.

.3 Remove paint, dirt, or other surface coverings at connection points to allow good metal-to-metal contact.

.4 Notify **Engineer** prior to backfilling ground connections.

.2 Exothermic Weld Type:

.1 Wire brush or file contact point to bare metal surface.

.2 Use welding cartridges and molds in accordance with manufacturer's recommendations.

.3 Avoid using badly worn molds.

.4 Mould to be completely filled with metal when making welds.

.5 After completed welds have cooled, brush slag from weld area and thoroughly clean joint.

.3 Compression Type:

.1 Install in accordance with connector manufacturer's recommendations.

.2 Install connectors of proper size for grounding conductors and ground rods specified.

.3 Install using connector manufacturer's compression tool having proper sized dies.

.4 Mechanical Type:

.1 Apply homogeneous blend of colloidal copper and rust and corrosion inhibitor before making connection.

.2 Install in accordance with connector manufacturer's recommendations.

.3 Do not conceal mechanical connections.

3.9 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Fire alarm, intercommunication systems as required by manufacturer.

3.10 SURGE EQUIPMENT GROUNDING

.1 Connect surge arrestor ground terminals to equipment ground bus.

3.11 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 16010 – Electrical General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

SECTION 16505
LIGHTING EQUIPMENT

SECTION 16505
LIGHTING EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

.1 Furnish all labour, materials, supervision, equipment and services specified, indicated or requested to install the lighting equipment specified herein and on the drawings.

.2 Exit lights and emergency lighting units must be supplied by one manufacturer only throughout the project.

1.2 REFERENCES

.1 The following is a list of standards which may be referenced in this Section:

.1 Institute of Electrical and Electronic Engineers (IEEE): C62.41, Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.

.2 Canadian Standards Association CSA C22.1 No. 141 Unit Equipment for Emergency Lighting.

.3 Certified Ballast Manufacturer (CBM).

.4 Illuminating Engineering Society of North America (IESNA).

.5 National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

.6 Underwriters Laboratories, Inc. (ULC):

.1 NFPA No. 101 Life Safety Code.

.2 Ontario Electrical Safety Code (OESC)-Latest Edition.

1.3 RELATED SECTIONS

.1 Section 01330 Submittals

.2 Section 16010 General Electrical Requirements

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01330 – Submittals.

.2 Shop Drawings, information and data:

.1 Solid-State Light Fixture and Lighting Emitting Diode (LED) equipment (Drivers & Power Supplies) manufacturer data including:

.1 Type.

.2 Wiring diagram for power supplies and LED drivers.

.3 Photometric data measured per LM-79.

.4 Lumen Maintenance data per LM-80 at L70 and L50 at both 25°C and 50°C ambient temperatures.

.5 Installed Watts.

.6 Input voltage and power factor.

.7 Initial lumens and lumens per Watt.

.8 Colour temperature and Colour Rendering Index.

.9 Bin number requirements for colour temperature consistency.

.10 Temperature rating.

.11 Efficiency rating.

.12 Manufacturer shop drawing submittals to include:

.1 Catalogue data sheets and pictures.

.2 Luminaire finish and metal gauge.

.3 Lens materials, pattern, and thickness.

.4 Mounting, fastening, foundation, anchoring, suspension details and dimensions.

.13 Lighting controls including photocell, time switch and lighting control panel details.

.1 All lighting control panels for dimming and relay shall be furnished by one manufacturer and are compatible with occupancy sensors, switches, preset controllers and photocell sensors. All lighting control panels shall be CSA certified.

.14 Manufacturer warranty statement compliant with listed requirements.

.2 Interior Luminaires:

.1 Catalogue data sheets and pictures.

.2 Luminaire finish and metal gauge.

.3 Lens material, pattern, and thickness.

.4 Candle power distribution curves in two or more planes.

.5 Candle power chart 0 to 90 degrees.

.6 Lumen output chart.

.7 Mounting details.

.3 Exterior Luminaires:

.1 Catalogue data sheets and pictures.

.2 Luminaire finish and metal gauge.

.3 Lens material, pattern, and thickness.

.4 IESNA lighting classification and isolux diagram.

.5 Fastening details to wall.

.6 Ballast type, location, and method fastening.

.4 Lamps:

.1 Voltages.

.2 Colours.

.3 Approximate life (in hours).

.4 Approximate initial lumens.

.5 Lumen maintenance curve.

.6 Lamp type and base.

.5 Ballasts and Driver:

.1 Type.

.2 Wiring diagram.

.3 Nominal watts and input watts.

.4 Input voltage and power factor.

.5 Starting current, line current, and re-strike current values.

.6 Sound rating.

.7 Temperature rating.

.8 Efficiency ratings.

.9 Low temperature characteristics.

.10 Emergency ballasts rating and capacity data.

.6 Photo Time Control:

.1 Wiring diagram.

.2 Contact ratings.

.7 Photocells:

.1 Voltage, and power consumption.

.2 Ampacity.

.3 Contacts and time delay.

.4 Operating levels.

.5 Enclosure type and dimensions.

.6 Temperature range.

.8 Low Voltage Remote Control Wiring System:

.1 Type.

.2 Switching capacity.

.3 Voltage rating.

.4 Wiring diagrams.

.3 Warranty

.1 Provide a written five-year warranty on-site replacement material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products. Finish warranty must include warranty against failure or substantial deterioration such as blistering,

cracking, peeling, chalking, or fading. Also, this replacement warranty shall cover for luminaires producing inadequately maintained illuminance levels at end of warranty period, as prorated from levels expected at end of useful life. For example, a luminaire expected to produce 70% of initial lumens at 100,000 hours would be expected to last over 11 years (continuous operation), so levels would be expected to be at 87% of initial at end of five-year warranty period. Warranty must cover all light sources (LED package, LED array, or LED module) including, but not limited to the LED die, encapsulate, and phosphor. If the expected useful life of the luminaire system as defined is not maintained, then the manufacturer must replace the light source(s) or luminaire as needed.

.2 Provide a written five-year replacement material warranty for defective or non-starting LED source assemblies from the date of substantial acceptance of the work. Include labour for replacing lamps and drivers in warranty.

.3 Provide a written five-year replacement material warranty on all power supply units (PSUs).

.4 Warranty period must begin on date of substantial completion. The supplier will provide the Agent with appropriate signed warranty certificates. The Agent must receive certificates prior to final payment.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Store in original cartons, in a dry and protected space.

PART 2 PRODUCTS

2.1 LUMINAIRES

.1 Refer to Luminaire schedule in contract drawings.

.2 Feed-through type or separate junction box.

.3 Ballasts: Two-lamp when possible.

.4 Wire Leads: Minimum 12 AWG.

.5 Component Access: Accessible and replaceable without removing luminaire from ceiling.

.6 LED Requirements: Luminaires must meet the following requirements:

.1 40 to 50 lumens per watt (6500°K).

.2 30 to 40 lumens per watt (3200°K).

.3 1.2 or 3 watts per LED.

.4 Bin number requirements for colour temperature consistency.

.5 Maximum temperature at the base of the “LED cap” mounted to the substrate shall be controlled to ensure full lamp life.

.6 Warranty: 5 years.

.7 Luminaire must be UL-listed for wet locations and wiring cavity must be field accessible for service or repair needs.

.8 Fully assemble and electrically test luminaires before shipment from factory.

.9 Luminaires must have locality-appropriate governing mark and certification.

.10 If a lens not integral to the LED is used, construct the luminaire optical enclosure (lens/window) of clear and UV-resistant polycarbonate, acrylic or glass.

.11 80% of the luminaire material by weight should be recyclable at end of life. Design luminaire for ease of component replacement and end-of-life disassembly.

.7 Soffit Installations

.1 ULC Labelled: suitable for damp locations.

.2 Ballast: Removable, prewired.

.8 Exterior Installations

.1 ULC Labelled: suitable for wet locations.

.2 Ballast: Removable, prewired.

.3 When factory installed photocells are provided, entire assembly shall have ULC label.

2.2 EMERGENCY LIGHTING UNITS

.1 Emergency Battery Units

.1 Performance: In accordance with CSA 22.2-141.

.2 Design: packaged battery powered units.

.3 Batteries: 24 volts, sealed pure lead design, suitable for -20°C to 40°C ambient, with minimum capacity for carrying lamp loads plus 25 percent spare capacity (minimum 50 watts total) for one hour (based on ambient of 20°C), rechargeable, maintenance free type, with high impact material container.

.4 Battery Charger: Solid state, automatic, two rates with capacity to restore battery to full charge with 12 hours following one-hour full rate discharge.

.5 Solid State Switching: Automatically connect lamps to battery upon failure of 120V AC power or when supply voltage drops below 90V. Supply a sealed type transfer relay and a low battery voltage disconnect circuit. Include a time delay as noted on the Luminaire Schedule.

.6 Accessories: Test switch and LED pilot lights to indicate when battery being charged and when battery fully charged.

.7 Lamps: See the Luminaire Schedule on Contract drawings.

.8 Enclosure type as per the Luminaire Schedule.

.9 Include 1220 mm long, three wire cord with U ground, twist-lock plug for connection to receptacle outlet. Coordinate plug and receptacle type and location to suit.

.10 Battery Life: 10 years minimum maintenance free. Warrant battery and charger for five years.

2.3 EXIT LIGHT

.1 Refer to Luminaire schedule in contract drawings.

.2 Fixture: UV stabilized polycarbonate or die cast aluminum housing, with universal mounting bracket (wall, end or ceiling), integral solid-state battery charger, low battery voltage disconnect and load transfer for operation on 120 volts AC.

.3 Battery: Sealed NI-CAD type, minimum one-hour capacity (20 degrees Celsius ambient), and 10-year maintenance free design.

.4 Features: LED type lamps, test switch, rate of charge indicating LED light and low battery voltage disconnect and warning LED light. Illuminated face with 150 mm red letters on white background, English wording, single or double face as required, with universal arrow adjustment.

2.4 LAMPS

.1 See the Luminaire Schedule on the Contract drawings.

2.5 BALLASTS

.1 General

.1 Meet requirements for fixture light output, reliable starting, radio interference, total harmonic distortion, electromagnetic interference, and dielectric rating.

.2 Certified by electrical testing laboratory to conform to Certified Ballast Manufacturer's specifications.

.2 LED Driver

.1 Must have a minimum efficiency of 85%.

.2 Must be rated to operate between -40°C to +50°C.

.3 Input Voltage: capable of 120 to 240 (±10%) volt, single phase as required by the site.

.4 Power supplies can be UL Class I or II output.

.5 Operating frequency must be 50/60 Hz.

.6 Drivers must have a Power Factor (PF) of: ≥0.90.

.7 Drivers must have a Total Harmonic Distortion (THD) of: ≤20%.

.8 Drivers must comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.

.9 Drivers must be compliant with Reduction of Hazardous Substances (RoHS) regulations.

2.6 LIGHTING CONTROL

.1 Photocell

.1 Automatic ON/OFF with HAND/OFF/AUTO selector switch for switching photo control.

.2 Housing: Self-contained, die cast aluminum, unaffected by moisture, vibration, or temperature changes.

.3 Setting: ON at dusk and OFF at dawn.

.4 Time delay feature to prevent false switching.

.5 Field adjustable to control operating levels.

.6 Manufacturers:

.1 Tork Inc.

.2 Or Agency approved equivalent.

2.7 SPARE PARTS

.1 Furnish, tag, and box for shipment and storage the following spare parts and materials:

.1 Provide a list of manufacturers recommended spare parts.

.2 Provide all necessary spare parts as recommended by manufacturer.

PART 3 EXECUTION

3.1 LUMINAIRES

.1 General

.1 Locate and install luminaries and switches as indicated in accordance with manufacturer's recommendations.

.2 Provide proper hangers, pendants, and canopies as necessary for complete installation.

.3 Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building required to safely mount.

.4 Install plumb and level.

.5 Co-ordinate location of luminaries with all trades onsite.

.6 Connect luminaries and switches to lighting circuits as indicated.

.2 Luminaire Supports

.1 For suspended ceiling installations support luminaries independently of ceiling.

.2 Suspend luminaires at a height of no less than 2500 mm from the floor and below any piping attached to the ceiling.

.3 Luminaire Alignment

.1 Align luminaries mounted in continuous rows to form straight line.

.2 Align luminaries mounted individually parallel or perpendicular to building grid lines.

3.2 LAMPS

.1 Provide in each fixture, number and type for which fixture is designed, unless otherwise noted.

3.3 BALLASTS

.1 Install in accordance with manufacturer's recommendations.

.2 Utilize all ballast mounting holes to fasten securely within luminaire.

.3 Replace noisy or defective ballasts.

3.4 LIGHTING CONTROL

.1 Outdoor Luminaires: Photocells switch lights ON at dusk and OFF at dawn.

3.5 EXIT LIGHTS INSTALLATION

.1 Install exit lights at locations indicated in the Contract Documents and as required, in accordance with NBC-1985.

.2 Install exit lights as indicated,

.3 Install wall mounted units 2250 mm above finished floor in office areas and 300 mm above doorway opening in other areas.

.4 Wire fixtures to exit light circuits as indicated.

.5 Connect emergency lamp sockets to emergency circuits as indicated.

.6 Ensure that exit light circuit breaker is locked in on position.

3.6 EMERGENCY LIGHTING UNITS' INSTALLATION

.1 Fill batteries delivered in dry state with electrolyte.

.2 Provide integral and remote heads as specified and indicated.

.3 Install unit equipment and remote mounted heads (fixtures) as indicated, in accordance with manufacturer's recommendations.

.4 Direct heads as indicated.

.5 Connect exit lights emergency lamp to emergency lighting unit as indicated.

.6 Provide permanent circuit connections with conduit and wire.

.7 Connect to branch circuit feeding normal lighting in area ahead of all local switches.

.8 Provide separate circuit wiring to luminaire.

3.7 CLEANING

.1 Remove labels and markings, except ULC or CSA listing mark.

.2 Wipe luminaires inside and out to remove construction dust.

.3 Clean luminaire plastic lenses with antistatic cleaners only.

.4 Touch up painted surfaces of luminaires and poles with matching paint ordered from manufacturer.

.5 Replace defective lamps at time of Substantial Completion.

END OF SECTION

SECTION 16671
SURGE PROTECTION DEVICE

SECTION 16671
SURGE PROTECTION DEVICE

PART 1 GENERAL

1.1 GENERAL CONDITIONS

.1 All sections of Division 1 form a part of this specification.

.2 Refer to all other divisions of specifications to determine their effect upon the work of this section.

1.2 SCOPE

.1 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments (as tested by ANSI/IEEE C62).

.2 The Contractor shall furnish and install the surge protection device (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

1.3 REFERENCES

.1 The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

.1 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)

.2 American National Standards Institute

.3 Federal Information Processing Standards Publication 94 (FIPS PUB 94)

.4 National Electrical Manufacturer Association (prior to repeal NEMA LS-1 1992 Peak Current Testing)

.5 National Fire Protection Association (NFPA 70, 75 and 780)

.6 MIL Standard 220A Method of Insertion Loss Measurement

.7 National Electric Code

.8 Underwriters Laboratories UL 1283 and UL 1449 (most recent edition)

.9 Canadian Standards (cUL or cETL)

.10 National Electrical Manufacturers Association (NEMA)

.11 Occupational Safety and Health Act (OSHA)

1.4 ENVIRONMENTAL REQUIREMENTS

.1 The operating temperature range shall be -40° to 70° C (-40° to 160° F).

.2 The unit shall be capable of operation up to 13,000 feet above sea level.

.3 No appreciable magnetic fields shall be generated.

1.5 SUBMITTALS

.1 Product Data: Provide catalog sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length.

.2 Submit product data for all components and accessories.

.3 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

.4 List and detail all protection systems such as fuses, disconnecting means and protective features.

.5 Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA approvals.

.6 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41 Category C3 & C1 (combination wave) and A1 (ring wave) tested in accordance with ANSI/IEEE C62.45.

.7 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 10 kHz and 100 kHz verifying the devices noise attenuation equals or exceeds 40 dB at 100 kHz.

.8 For retrofit mounting applications, provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

.9 Provide test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on a per mode

basis using the IEEE C 62.41, 8x20 microsecond current wave. Test data must be on a complete SPD with internal fusing in place. Test data on an individual module is not acceptable.

1.6 QUALITY ASSURANCE AND WARRANTY

.1 The panel mounted SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of thirty (30) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Additionally, the warranty shall state that during the applicable warranty period any SPD which fails due to any transient surge activity, including lightning, shall be repaired or replaced by the manufacturer without charge. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

.2 Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this particular section. That is, the warranty must specifically provide for unlimited free replacements of the SPD in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

.3 Provide electrically operated equipment specified in this Section that is listed and labeled. As defined in the National Electrical Code, Article 100, Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

.4 Comply with NFPA 70 and NEMA LS1.

1.7 MANUFACTURER QUALIFICATIONS

.1 The SPDs shall be manufactured in the USA by a manufacturer that has been regularly engaged in the design, manufacturing and testing of SPDs of the types and ratings required for a period of not less than five years. Manufacturers requesting product approval must meet or exceed the written specification contained herein. Manufacturers requesting approval must receive written verification of product acceptance by the specifying engineer 10 days prior to the bid date.

1.8 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01300 – Submittals.

.2 Provide verification that the SPD device complies with the required UL 1449 2nd Edition.

.3 Submit electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration and proposed mounting configuration.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.10 OPERATION AND MAINTENANCE MANUALS

.1 Submit Operation and Maintenance Manuals in accordance with Section 01730 – Operation and Maintenance Manuals.

1.11 WARRANTY

.1 The manufacturer shall provide a full thirty (30) year unlimited free replacement warranty from the date of installation against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

PART 2 PRODUCTS

2.1 PERFORMANCE

.1 General

.1 The SPD shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (latest edition, latest revision), and not merely the components or modules. All SPDs shall be Type 1 for use in Type 1 and Type 2 locations.

.2 The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

.3 Obtain all surge suppression devices through one source from a single manufacturer.

.4 The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 600V systems.

.5 All SPDs shall be equipped with a comprehensive monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.

.6 No unit will be accepted as an “approved equal” unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, independent third party per mode surge testing, and all other requirements of this specification.

.7 Each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing at an independent, nationally recognized test laboratory. To be considered for approval, the manufacturer must submit a test report on a unit which was tested with internal over current fusing in place. The test shall include a 1.2 X 50 µsec 6000V open circuit voltage waveform and an 8 X 20 µsec 500A short circuit current waveform to benchmark the unit’s suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 µsec waveform. To complete the test, another identical surge shall be applied to verify the unit’s survival. Compliance is achieved if the suppression voltage found from the two impulses does not vary by more than +10%. Test data on an individual module is not acceptable.

.2 LIGHTING PANEL PROTECTION - 'LP-1'

.1 SPD(s) for this location shall be as indicated on project drawings. SPD can be separate from panelboard. SPDs shall be certified to UL1283 and UL1449 Third Ed. Type 1 for use in Type 1 and Type 2 locations.

.2 Subpanels and lighting panels shall be protected by a Total Protection Solutions panel mounted SPD TK-LP080-3Y208-L-F or equivalent Eaton model for 120/208 (4W+G) volt panels.

.3 The manufacturer shall provide written specifications showing let-through voltage of the unit with six inches of lead length (at the module or at the lug data is not acceptable as it does not represent true "as installed" performance) pursuant to ANSI/IEEE C62.41 and C62.45, 2002, categories A1 & A3 ring wave, 180 degree phase angle, category B3 Ring wave, and UL suppressed voltage ratings, 90 degree phase angle, positive polarity, measurements in peak voltage from the zero reference, all dynamic tests except N-G, which shall be no higher than:

.1 ANSI/IEEE C62.41-1991 Measured Limiting Voltage

.1 A1 Ring Wave (2kV, 67A) Tested at 180 degree phase angle

.1 Voltage (Voltage Code): L-N, L-G, L-L, N-G

.2 120/208 (3Y208): 29V, 46V, 39V, 40V

.2 A3 Ring Wave (6kV, 200A) Tested at 180-degree phase angle

.1 Voltage (Voltage Code), L-N, L-G, L-L, N-G

.2 120/208 (3Y208): 56V, 81V, 88V, 112V

.3 B3 Ring Wave (6kV, 500A) Tested at 90-degree phase angle

.1 Voltage (Voltage Code): L-N, L-G, L-L, N-G

.2 120/208 (3Y208): 437V, 592V, 612V, 324V

.4 UL Voltage Protection Ratings

.1 Voltage (Voltage Code): L-N, L-G, L-L, N-G

.2 120/208 (3Y208): 700V, 700V, 1000V,700V

.4 The unit shall have a peak surge current of no less than 80 kA/phase, 40 kA/mode, 8 X 20 us waveform, single impulse, verified by third party test reports.

.5 Internal Fusing - Overcurrent Protection

.1 Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Overcurrent fusing that limits the listed peak surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode overcurrent fusing is not acceptable where there is more than one MOV per mode.

.2 For arc quenching capability, minimization of smoke and contaminates in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.

.3 Fusing shall be present in every mode, including Neutral-to-Ground.

.6 The SPD shall be capable of attenuating internally generated ringing type transients and noise, and shall have an enhanced transient filter supported by a specification sheet which lists the IEEE A1 Ring Wave let-through levels no higher than those set forth above.

.7 The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability and shall have at minimum a Nema 1 steel enclosure.

.8 The SPD shall come standard with not less than a Thirty Year Warranty, and the warranty shall include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.

.9 The SPD shall have an internal audible alarm with mute on front cover.

2.2 MANUFACTURER

.1 International Innovative Systems

.2 Eaton

PART 3 EXECUTION

3.1 EXAMINATION

.1 The manufacturer or his representative shall examine the installation to ensure the equipment provided and methods used meet the requirements of the application and shall provide a Certificate of Proper Installations.

3.2 INSTALLATION

.1 Install the SPDs with the conductors as short and straight as practically possible.

.2 Follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

.3 Distribution, branch panel, and motor control center units shall be installed on 30-amp dedicated circuit breakers, or, where indicated, shall be wired directly to the main lugs or feed through lugs, or wired directly to the bus bars.

.4 When SPD cable lead lengths exceed four (4) feet, Low Impedance Cable must be used. Please follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation manual.

.5 The Dry Contact Relay (DRC) for the alarm must be wired to a signaling device specified by the engineer.

.6 The installing contractor shall comply with all applicable codes.

.7 A pre and post installation inspection with a commissioning report must be performed and submitted by a factory trained agent.

END OF SECTION

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The latest version of the "CSA-Approved Meter-Mounting Devices" document which is located on the Hydro One website will be considered acceptable. Meter-Mounting Device models not listed in this document, may be installed on the condition the model complies with the "Meter-Mounting Device Requirements" listed below. The models provided in this document are examples that are known to comply with the Hydro One requirement. Any deviation from this list of requirements must be approved by Hydro One prior to installation. Failure to install a Meter-Mounting Device as described in this document may result in the refusal to connect the service. Please refer to the Hydro One Retail Metering Guide for additional information.

Meter-Mounting Device Requirements

All Meter-Mounting Devices must meet these requirements:

No.	Requirement
1.	Meter-Mounting Device must be approved to CSA C22.2 No.115
2.	Meter-Mounting Device with Transfer Switch must be approved to CSA C22.2 No.178.1
3.	Meter-Mounting Device with Load Centre must be approved to CSA C22.2 No.29 or No.229
4.	Meter-Centre must be approved to CSA C22.2 No.229
5.	Accommodate meter ring or means to secure meter in place with tamper-proof seal.
6.	Transformer-Rated Meter-Mounting Devices must have a test switch, no automatic by-pass or shorting circuit.
7.	Follow OESC Bulletin 10-15-* for neutral conductor bonding, with preference given to isolating the neutral from the Meter-Mounting Device (insulated neutral kits listed in red below), except for multi position models.
Notes	1. Unless certified by the OEM using OEM equipment, field modification or alterations (e.g. drilled holes, altered lug connector) to the Meter-Mounting Device are not permitted unless approved by Hydro One. 2. Meter-Mounting Device shall not be used to provide tapping for a second service box.

Additionally, if Hydro One owns underground cable and is accountable for line side cable connection in Meter-Mounting Device the following also applies:

No.	Requirement
1.	Oversized Meter-Mounting Device with a minimum dimension of 17 H x 12 W x 4 ¾ D inch (432 x 305 x 121mm).
2.	Space above line side connection shall accommodate a half-loop (180 degrees) of extra cable length for frost loop and reconnection while maintaining cable bending radius.
3.	2-inch conduit knock-out when 3/0 service cable installed (single-phase service, 120/240V).
4.	3-inch conduit knock-out when 250MCM service cable is installed (single-phase service, 120/240V).
5.	Multi-Position must have blank compartment for cable entrance (either end of assembly).

The following list of Meter-Mounting Devices are examples that meet the requirements set by Hydro One:

Single Phase, Three-Wire Service, Self-Contained

120/240V 4-Jaw ANSI Form Factor 2S

SERVICE & TYPE	MANUFACTURER	MODEL	CONDUCTOR SIZE
200A Overhead/Underground	Hydel	EK400ROBC	No.6 – 250MCM Cu/Al
		EK200XL	No. 2 – 350MCM Cu/Al
	Microlectric®	BS2-INTCVBC	No.6 – 250MCM Cu/Al
	Eaton	LMB3-IN	No.6 – 250 MCM Cu/Al

120/240V 4-Jaw ANSI Form Factor 2S with Breaker

SERVICE & TYPE	MANUFACTURER	MODEL	CONDUCTOR SIZE
200A Overhead/Underground	Hydel	JA402R-BC	No.6 – 250MCM Cu/Al
	Eaton	RCJ2Q Series	No.6 – 250MCM Cu/Al
	Durham[2]	DR Series	No.6 – 250MCM Cu/Al
	Microlectric®	CO2-G Series	No.6 – 250MCM Cu/Al

120/240V 4-Jaw ANSI Form Factor 2S Specialty Base

SERVICE & TYPE	MANUFACTURER	MODEL	CONDUCTOR SIZE
Up to 200A Combination Base and Load-Centre Temp Service	Leviton	LS800-BRC Series	No.6 – 350MCM Cu/Al
	Eaton	RCPM Series	No.6 – 250MCM Cu/Al
100A or 200A Combination Base with Auto Transfer Switch	Eaton	EGS Series	No.6 – 250MCM Cu/Al
100A or 200A Combination Base with Manual Transfer Switch	Eaton	RCJ Series	No.6 – 250MCM Cu/Al
	Durham[2]	SB Series	No.6 – 250MCM Cu/Al
100A or 200A Overhead/Underground with Load Side Sub Feed Lug	Eaton	LMB3-SF N with EIN2	No.6 – 250MCM Cu/Al
	Hydel	SLC402RW	No.6 – 250MCM Cu/Al

[2]Contact Jesstec Industries Inc to order

120/240V 4-Jaw ANSI Form Factor 2S – Multi Position

SERVICE & TYPE	MANUFACTURER	MODEL	CONDUCTOR SIZE
200A Main 100A per position Overhead/Underground	Eaton	KN1 Series	No.6 – 250MCM Cu/Al
	Hydel	SDC Series	No.6 – 250MCM Cu/Al
200A Main 200A per position Overhead/Underground	Hydel	HC22R Series	No.6 – 250MCM Cu/Al
	Eaton	K2 Series	No.6 – 250MCM Cu/Al
	Microlectric®	BDA2 Series	No.6 – 250MCM Cu/Al
400A Main 200A per position Overhead/Underground	Hydel	HC40R Series	No.2-600MCM or 2 x 1/0-250MCM Cu/Al
	Eaton	K4 Series	No.2-600MCM or 2 x 1/0-250MCM Cu/Al
	Microlectric®	BS4 Series	No.4-600MCM or 2 x 1/0-250MCM Cu/Al
Meter-Centre >400A Main or more than 6 positions	Schneider Electric	Square D Series	

Single Phase, Three-Wire Service, Transformer Rated

120/240 5-Jaw ANSI Form Factor 3S

SERVICE & TYPE	MANUFACTURER	MODEL
400A *Must specify with vendor at time of order* 1. Overhead or Underground 2. Single or Parallel Cable Run 3. Size of Cable	Hydel	CT4-TSHO
	Microlectric®	JS4B-TLHO with IN4000JS
	Eaton	TCC5-H1 with ECLIN4
	Durham[2]	1011897-OH
CM Service Overhead/Underground	Durham[2]	1012109 (Overhead/Underground)
	Hydel	CTS405PW-TSHO w/ MSPMK7
	Eaton	TSU5C-H1C
	Microlectric®	CT105-SWLHO

[2]Contact Jesstec Industries Inc to order

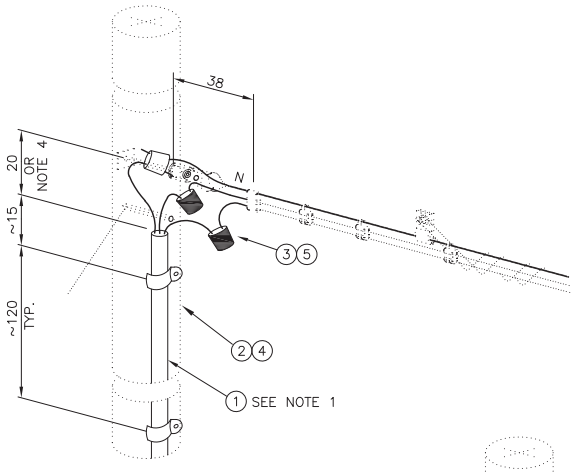


FIG.1
DEAD–END

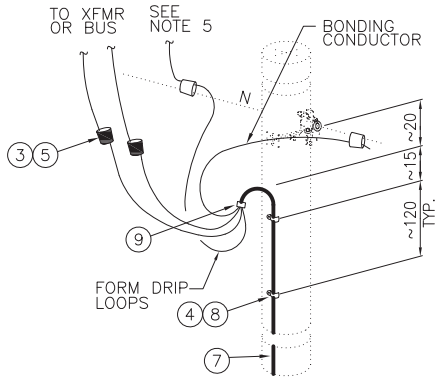


FIG.4
TYPICAL CUSTOMER OWNED ARMOURED CABLE SEE NOTE 2

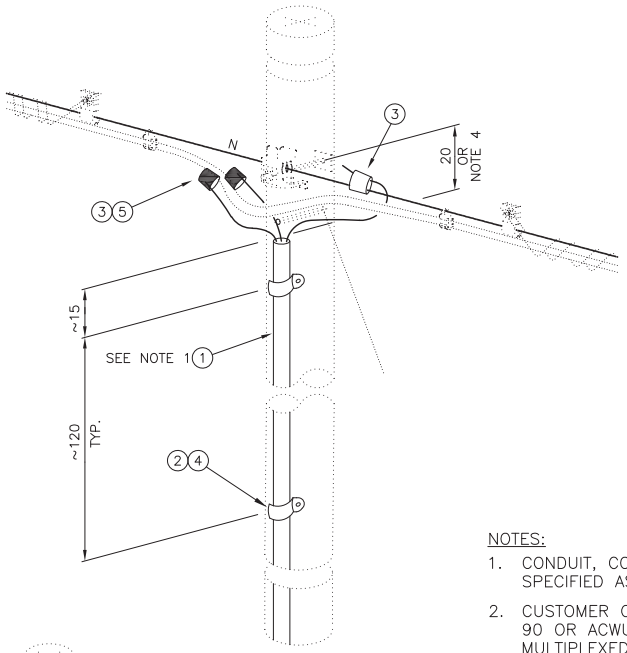
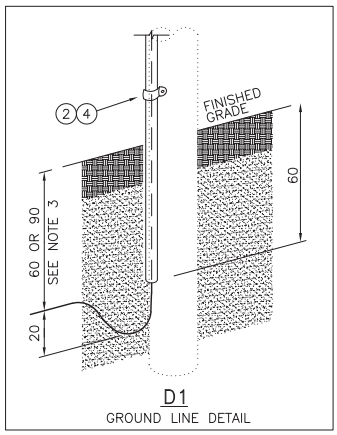


FIG.2
TANGENT



D1
GROUND LINE DETAIL

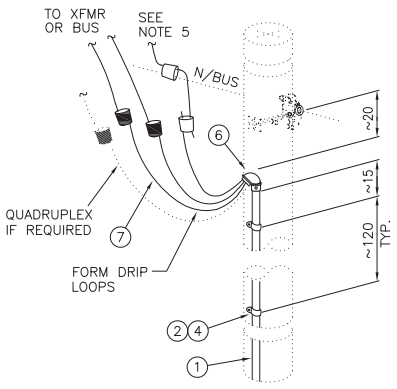


FIG.3
TYPICAL CUSTOMER OWNED UNDERGROUND SEE NOTE 2

NOTES:

1. CONDUIT, CONDUCTOR AND GUARD (IF REQUIRED) SPECIFIED AS PER DU5–303–0500.
2. CUSTOMER OWNED CABLE MAY BE ARMOURED (TECK 90 OR ACWU, INDIVIDUAL CONDUCTORS OR MULTIPLEXED CABLE) OR CABLE IN CONDUIT (RWU). SEE FIG.3 & 4. ALL ASSOCIATED PARTS TO BE SUPPLIED BY CUSTOMER.
3. DEPTH OF BURIAL IS MINIMUM 60cm ON PRIVATE PROPERTY OR 90cm ON ROAD ALLOWANCE. ROAD AUTHORITY APPROVAL REQUIRED WHEN TRENCHING ON ROAD ALLOWANCE. SEE DU11–102–0500.
4. TO FORM DRIP LOOPS, CONDUIT CAN BE RUN UP TO HEIGHT OF THE NEUTRAL IF DESIRED.
5. CONNECTION TO NEUTRAL, BUS OR TRANSFORMER TO BE MADE BY HYDRO ONE.

PARTS LIST

PART No.	MM No.	DESCRIPTION	QTY.
1	MM#	CONDUIT, PVC, RIGID	A/R
2	MM#	CLAMP, CONDUIT	A/R
3	MM#	CONNECTOR, TAP, WEDGE–TYPE	A/R
4	30001989	BOLT, LAG, HEX., 1/4", 2–1/2" LONG, GALV.	A/R
5	MM#	COVER, CONNECTOR, INSULATING	A/R
6	*	WEATHERHEAD	A/R
7	*	CONDUCTOR, ARMOURED	A/R
8	*	CLAMP (FOR PART #7)	A/R
9	*	BUSHING, TERMINATION (FOR PART#7)	A/R

MM# = REFER TO SECTION 16 ONLY A/R = AS REQUIRED

* = SUPPLIED BY CUSTOMER

ALL DIMENSIONS IN CENTIMETRES
UNLESS OTHERWISE STATED

Rev No.	Date	Revision Particulars	dwn	ckd	des	app
01	SEPT 2023	ORIGINAL DU–08–405–0500–R3 IS NOW SUPERSEDED BY THIS NEW DRAWING/REVISION. ADDED NOTE 1. UPDATED D1 TO FIG.3 AND D2 TO NEW D1. CHANGED TO SECTION 5. GENERAL UPDATES. CHANGED TO NEW DWG. & NUMBERING FORMAT.	PC	MM	KX	MM

Drawn By:	Checked By:	Designed By:	Design Approved By:
PC	M.MATEVSKI	K.XU	M.MATEVSKI P.Eng.
Scale: N.T.S.	Date: (yyyy/mm/dd) 2020/03/19	Pole ID:	

Hydro One Networks Inc.

Title: 1–PH OR 3–PH SECONDARY OVERHEAD TO UNDERGROUND TRANSITIONS (TRIPLEX OR QUADRUPLEX) UP TO 600V

Drawing No. DU5–403–0500 Rev. No. 01

A4 (210 x 297) millimetres 0 10 50 Sheet Number: /

TITLE BLOCK REV 02 – AUGUST 2014