CORPORATION OF THE TOWN OF RAINY RIVER

SPECIFICATION FOR

Water Treatment Plant Improvements

349 River Ave, Rainy River, ON

Project No.: 21-206

Prepared by:

TBT ENGINEERING
CONSULTING GROUP

1918 Yonge Street
Thunder Bay, Ontario
(807) 624-5160

March 2025

SEALS PAGE	
PROJECT TITLE:	Water Treatment Plant Improvements
PROJECT LOCATION:	349 River Ave, Rainy River, Ontario
PROJECT NUMBER:	21-206
DATE:	March 2025

ELECTRICAL ENGINEER		MECHANICAL ENGINEER	

SECTION **SECTION TITLE**

Division 00 – Procurement & Contracting Requirements

Division 01 – General Requirements

Division 03 – Concrete

Division 26 – Electrical

END OF SECTION

DWG NO.	DESCRIPTION	REVISION NO.
	Electrical	
E1	Site Plan, Generator Layout, Trench Details	0
E2	Generator Foundation Requirements	0
E3	Single Line Diagram Demolition & Renovation Requirements	0
E4	Main Floor Plan Demolition & Renovation Requirements	0
	Mechanical	
M1	Main Floor Plan, Mechanical Demolition	0

END OF SECTION

Part 1 General

1.1 INVITATION

.1 Bid Closing Time, Date and Location

.1 **Electronic bids, fully executed and dated will be received before, and not later than 4:30 pm CST, on April 10, 2025.**

.2 Bids shall only be received via email to Shara Lavellee (rrcao@tbaytel.net).

.3 Submissions through facsimile, hardcopy or telephone will not be accepted.

.4 The designated time piece for bid closing is determined by the time stamp on the email as to when the email is received by the Town of Rainy River, not by time stamp on the email as to when the email is sent by the tenderer.

.5 As bid transmissions may be delayed due to file transfer size, transmission speed and other factors, it is recommended the Bidders allow sufficient time to complete and electronically submit their bid to resolve any issues that may arise.

.6 Late or unsigned bids will not be considered.

1.2 INTENT

.1 Intent of this Bid call is to obtain an offer to perform work to complete improvement works to the water treatment plant located at 349 River Avenue, Rainy River, Ontario for a Stipulated Price contract, in accordance with Contract Documents.

.2 Perform Work within time stated in Section 01 11 00 - Summary of Work.

.3 Initiate Work within time stated in Section 01 11 00 - Summary of Work.

1.3 CONTRACT DOCUMENTS IDENTIFICATION

.1 Contract Documents are identified as TBT Engineering Project No. 21-206 – Water Treatment Plant Improvements as prepared by the Consultant, located at 1918 Yonge Street, Thunder Bay and listed in Table of Contents.

1.4 CONTRACT/BID DOCUMENTS

.1 Agreement Form.

.2 Definitions

.1 Contract Documents: Defined in CCDC 2 - 2020 Edition, Definitions.

.2 Bid Documents: Contract Documents supplemented with Instructions to Bidders, Bid Form and Bid Supplementary Forms identified herein.

.3 Bid, Offer, or Bidding: Act of submitting an offer under seal.

.4 Bid Price: Monetary sum identified in Bid Form as an offer to perform work.

.3 Availability

.1 **Bid Documents are available electronically from the Town of Rainy River.**

.2 Bid Documents are made available only for purpose of obtaining offers for this project. Their use does not confer license or grant for other purposes.

.4 Examination

.1 Upon receipt of Bid Documents verify that documents are complete.

.2 Immediately notify Consultant upon finding discrepancies or omissions in Bid Documents.

.5 Queries/Addenda

.1 **Submit questions via email to Shara Lavellee (rrcao@tbaytel.net).**

.2 Addenda may be issued during bidding period. All addenda become part of Contract Documents. Include costs in Bid Price.

.3 Verbal answers are only binding when confirmed by written addenda.

.4 Clarifications requested by bidders must be submitted not less than seven (7) working days before date set for receipt of Bids. Reply will be in form of an addendum, a copy of which will be posted to the Bidding System no later than five (5) working days before receipt of Bids. **Last day for questions will be 4:30 pm CST Friday, March 27, 2025. Last Addendum will be issued by 4:30 pm CST Wednesday, April 3, 2025.**

.6 Product/System Options

.1 Where Bid Documents stipulate a particular product, specified product shall form the basis of the bid and shall be supplied for the Work without substitution in any detail, subject to allowable substitutions as approved. Where several products are specified, any one of the specified items is acceptable.

.2 A request to substitute a product can be made during the tender period at which time the Consultant may approve it as an equal if the proposed item exceeds the specified product or provides a cost savings to the owner. Final determination of the acceptability of substitution shall be at the discretion of the owner and consultant whose decision shall be final and without recourse.

.3 In submission of substitutions to products specified, Bidders shall include any changes required in work to accommodate such substitutions. A later claim by Bidder for an addition to contract price because of changes in work necessitated by use of substitutions shall not be considered.

.4 Submission shall provide sufficient information to enable Consultant to determine acceptability of such products.

.5 Provide complete information on required revisions to other work to accommodate each substitution, including revisions to other work.

.6 Unless substitutions are submitted in this manner and subsequently accepted, provide products as specified.

.7 Approval to submit substitutions prior to submission of Bids is not required.

1.5 SITE ASSESSMENT

.1 Site Examination and Meeting

.1 It is recommended for each Bidder to visit the project site and surrounding area before submitting Bid, so as to satisfy himself by personal examination as to the local conditions to be encountered during the design, delivery, installation and commissioning of the work. Each Bidder shall make his own estimate of the difficulties to be encountered. Bidders shall not claim at any time after submission of their tender that there was any misunderstanding of the terms and conditions relating to site conditions.

.2 **An optional Site Examination and Meetings for bidders at the project site may be coordinated with the Town of Rainy River.**

Project site: Water Treatment Plant, 349 River Avenue, Rainy River, Ontario

1.6 QUALIFICATIONS

.1 No bid shall be accepted from any contractor, its principals, directors or any officer of that firm, or another related person, as determined by owner in his or her sole and unreviewable discretion, with whom the owner is engaged with in unresolved litigation.

.2 Bidders should demonstrate that they have the necessary staffing, facilities, experience, abilities and financial resources to perform the work in a satisfactory manner. Contractor is to provide list of three representative projects which demonstrate a proven track record complete with references. Use the form Appendix A included in the Bid Form. **Failure to provide references and details of experience may result in submission not being considered.**

.3 Owner reserves right to reject a proposed subcontractor for reasonable cause.

1.7 BID SUBMISSION

.1 Bid Ineligibility

.1 Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, shall at discretion of Owner, be declared informal.

.2 Bids with Bid Forms and enclosures which are improperly prepared shall, at discretion of Owner, be declared informal.

.3 Bids that fail to include security deposit, bonding or insurance requirements shall, at discretion of Owner, be declared informal.

.4 Bids are only from bidders registered with the consultant at the Mandatory Site Evaluation. Bids from unsolicited bidders will not be considered.

.2 Submissions

.1 Bidders shall be solely responsible for delivery of their Bids in manner and time prescribed.

.2 Improperly completed information, irregularities in security deposit or bid bond, shall be cause not to declare Bid informal.

1.8 BID ENCLOSURES / REQUIREMENTS

.1 Bid Security

.1 Bids shall be accompanied with a bid security consisting of an electronic Bid Bond in the amount of not less than 10% of the total bid price **for projects exceeding $100,000.00.**

.2 Bid Bond shall be on the latest edition of the Canadian Construction Association's (CCA) Bid Bond Form, Document No. CCDC 220 and shall be written in the name of the Owner.

.3 Bid securities will be returned after delivery to Owner of required Performance and Labour and Materials Payment Bond(s) by accepted bidder.

.4 Bid securities shall be returned to unsuccessful bidders within a reasonable time after consideration and award of the contract.

.5 If no contract is awarded, all bid securities will be returned.

.2 Agreement to Bond.

.1 Submit with Bid Form and Bid Bond, a Consent of Surety, stating that surety is willing to supply a Performance and Labour and Materials Payment Bond in the amount of 50% of the contract. See CCDC2-2020 Supplemental Conditions for Performance and Labour and Materials Payment Bond requirements.

.2 Include cost of bonds in Bid Price.

.3 Performance Assurance

.1 Accepted Bidder must provide Performance and Labour and Materials Payment Bond as described when selected bidder is asked to enter into a contract. The bond shall continue in force for the length of the project, including any maintenance periods.

.2 Include cost of bonds in Bid Price.

.4 Insurance

.1 Provide signed "Undertaking of Insurance" on standard form provided by insurance company stating intention to provide insurance to Bidder in accordance with insurance requirements of Contract Documents.

.2 The successful bidder shall, at its own expense, obtain and maintain until the termination of the contract, and provide the owner with Comprehensive General Liability Insurance on an occurrence basis for an amount not less than Five Million Dollars ($5,000,000.00) and shall include the owner, the consultant and any sub-consultants as an additional insured with respect to the owner's operations, acts and omissions relating to its obligations under this Agreement. Such policy is to contain a Cross Liability Clause and include Complete Operations coverage for 12 months from Completion, Blanket Contractual Liability, Contingent Employers Liability, Non-owned Automobile Liability, Broad Form Property Liability in accordance with CCDC41 and Excavation.

.5 Bid Form Requirements.

.1 State in Bid Form, time required to complete work.

.2 Bidder, in submitting an offer, agrees to complete work by date indicated in Contract Documents.

.3 Refer to Bid Form for inclusion of taxes.

.6 Bid Signing

.1 Bid form shall be signed under seal by Bidder.

.2 Sole Proprietorship: Signature of sole proprietor in presence of witness who will also sign. Insert words "Sole Proprietor" under signature. Affix seal.

.3 Partnership: Signature of all partners in presence of witness who will also sign. Insert word "Partner" under each signature. Affix seal to each signature.

.4 Limited Company: Signature of duly authorized signing officer(s) in normal signatures. Insert officer's capacity in which signing officer acts, under each signature. Affix corporate seal. If Bid is signed by officials other than President and Secretary of company, or President-Secretary-Treasurer of company, copy of by-law resolution of Board of Directors authorizing them to do so must also be submitted with in Bid envelope.

.5 Joint Venture: Each party of joint venture must execute Bid under respective seals in manner appropriate to such party as described above, similar to requirements of Partnership.

.6 Contractor shall fill in Appendix B List of Sub-Contractors in the Bid Form with all sub-trade information and pricing used in the preparation of their Bid Price.

1.9 OFFER ACCEPTANCE/ REJECTION

.1 Duration of Offer

.1 Bids shall remain open to acceptance and irrevocable for a period of Ninety (90) days after the Bid closing date.

.2 Acceptance of Offer

.1 Owner reserves the right to accept or reject any or all offers.

.2 After acceptance, Owner will issue to successful Bidder, written Bid acceptance.

.3 After a Bid has been accepted, unsuccessful Bidders security deposits will be returned and other requested enclosures.

1.10 HOURS OF WORK

.1 Normal hours of work at this job site are Monday to Friday – 7:00 a.m. – 3:00 p.m. Work outside of the normal hours is to be coordinated with the owner.

.2 All destructive demolition, construction in occupied areas, to be performed outside of normal working hours, unless agreed upon by Owner.

.3 Any required electrical, gas or domestic water shutdown(s) for service upgrades to be coordinated with both the Owner and the consultant.

1.11 AWARD

.1 In the prescribed timeframe in the notification from the owner informing the Vendor that it is the preferred bidder ("letter of notification"), the preferred Vendor shall deliver to the owner:

.1 Performance Bond equal to 50%
.2 Labour and Material Payment Bond equal to 50%
.3 An executed CCDC 2 2020 Contract

.4 Notice of Project
.5 Project specific certificate of insurance
.6 WSIB certificate
.7 Critical Path Method schedule

END OF SECTION

Part 1 Submission

1.1 TENDER FOR THE CONSTRUCTION OF

.1 Project Number: 21-206

.2 Project Title: Water Treatment Plant Improvements

.3 Project Adress: 349 River Ave, Rainy River, Ontario

1.2 OWNER AND TENDERER

.1 The following Tender is hereby submitted to:

Corporation of the Town of Rainy River

201 Atwood Ave Box 488

Rainy River ON P0W 1L0

Hereinafter called the "Owner"

.2 This proposal is submitted by:

_____

Name of Company

_____

Street Address

_____

City or Town

_____

Postal Code

_____

Telephone

_____

E-mail

_____

Facsimile

Hereinafter called the "Tenderer"

1.3 SIGNATURES AND CORPORATE SEAL

Print Name of Signing Officer	Signature of Officer
Print Name of Witness	Signature of Witness
(Place Corporate Seal over signatures)	Date (dd/mm/yyyy)

(We), the undersigned, having fully examined the locality and Place of the Work, having fully investigated the conditions of the Work, having read and understood the Contract Documents (comprised of the tendering information, supplementary general conditions, general conditions, specifications and drawings, including all supplements, addenda and revisions to same to the date of this tender) and having secured all of the information necessary to enable the submission of this tender, hereby agree and offer to perform the totality of the Work described in the Contract Documents, in accordance with the Contract Documents, for the Total Bid Price (excluding H.S.T) of:

_____ **Dollars**

(Insert Bid Price in Words, Bid Price indicated above takes precedence over sum of Individual Amounts Below)

$_____ **Canadian**

(Insert Bid Price in Numbers)

$_____ **HST**

(Insert HST in Numbers)

1.4 BID PRICE BREAKDOWN

Description	Amount
1. General Requirements, Bonding, Insurance	$_____
2. Demolition.....	$_____
3. Structural Work	$_____
4. Electrical Work	$_____
5. Closeout, Manuals, Commissioning	$_____
TOTAL BID PRICE	**$_____**

1.5 OWNERS RIGHT TO EVALUATE TENDERS

.1 I/We understand that the Owner reserves the right to evaluate the tender in such a manner that is there are additions or deletions to the base bids, these additions or deletions may be used to determine a total bid price and may have a bearing on award of this contract.

1.6 OWNERS RIGHT TO REJECT TENDERS

.1 I/We understand that the Owner reserves the right to reject the lowest or any tender without cause.

1.7 ADDITIONS AND DEDUCTIONS

.1 The Tenderer agrees that, if this tender is accepted by the Owner:

.1 it will carry out any additional or extra work (including the supplying of any additional Products pertaining thereto) or will delete any work as may be required by the Contract Administrator in accordance with the Contract; and,

.2 the carrying out of any work referred to in paragraph (i) above or the issuance by the Contract Administrator of a Contract Change Order relating to such work or the acceptance by the Tenderer of such Contract Change Order shall not, except as expressly stated in such Contract Change Order, waive, affect or vary any of the terms of the Contract or of a Contract Change Order previously issued by the Contract Administrator or any of the rights of the Owner or of the Contract Administrator under the Contract.

.2 The Tenderer agrees that, if this tender is accepted by the Owner the prices applicable to work referred to in paragraph 1.4.1 above shall be determined as follows:

.1 The Schedule of Tender Prices shall apply where applicable;

.2 If the above Schedule is inapplicable the prices shall be determined in accordance with the General Conditions or as amended by the Supplementary General Conditions.

1.8 ADDENDA

.1 We agree that we have received Addenda _____ to _____ inclusive, and the tender price includes for the provisions set out in such Addenda.

1.9 CONTRACT TIME

.1 I/we agree to commence the Work as specified, to proceed continuously to completion.

1.10 DECLARATIONS OF TENDERER

.1 The Tenderer declares that no person, firm or corporation other than the Tenderer has any interest in this tender or in the proposed Contract for which this tender is made.

.2 The Tenderer declares that this tender is made without any connection, comparison of figures or arrangement with, or knowledge of, any other corporation, firm or person making a tender for the same Work and is in all respects fair and without collusion or fraud.

1.11 CONDITIONS OF TENDER

.1 This tender is irrevocable from the official closing time and is unconditionally open for acceptance for 60 days after the official closing time, whether any other tender has been previously accepted or not. In cases where the expiry date of the acceptance period falls on a Saturday, Sunday or holiday, the time for acceptance shall be extended to the first following business day.

1.12 DISCLAIMER

.1 The Tenderer agrees and acknowledges there is no representation, warranty, collateral agreement or condition, whether direct or collateral, or expressed or implied, which induced the Tenderer to submit this tender, or on which reliance is placed by the Tenderer, or which affects this tender.

Part 2 Contractor's Example Projects and References

.1 I/We also submit three sample projects that is representative of our experience. I/We authorize the owner or its representatives to contact the persons listed as references.

2.2 PROJECT #1

Client:

Reference Contact:

Phone No.:

Project Address:

Project Description:

2.3 PROJECT #2

Client:

Reference Contact:

Phone No.:

Project Address:

Project Description:

2.4 PROJECT #3

Client:

Reference Contact:

Phone No.:

Project Address:

Project Description:

Part 3 List of Subcontractors

.1 I/We also submit the names of our proposed Sub-Contractors who will be utilized in the Work should we be successful, from whom sub-bids were received, and upon which my/our Bid is based:

Trade	Company	Sub-Bid Price

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Contract Method.

.3 Work sequence.

.4 Contractor use of premises.

.5 Owner occupancy.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work under this Contract involves completing the removal of the existing standby generator and the installation of a new diesel-fired generator and associated peripherals at the Water Treatment Plant located in Rainy River, ON. This Work includes, but is not limited to the following items:

.1 All required pre-contract and pre-construction submittals.

.2 Submission of all required Shop Drawings, complete with record of items submitted, submittal dates, returns, and re-submittals. Maintain a complete set of approved shop drawings at the Site.

.3 Coordination, supply, delivery, storage, and security of all equipment and material required to complete the Work.

.1 Installation of temporary services during construction, and subsequent removal upon completion.

.2 Demolition, removal, and disposal of existing generator and associated mechanical and electrical systems.

.3 Construction of new generator compound consisting of concrete pad and fencing outside the facility.

.4 Supply and install of new generator complete with sub-base fuel tank, load bank, Automatic Transfer Switch (ATS), and associated electrical equipment and devices.

.5 All required permits, regulatory inspections, testing, certification, and acceptance.

.6 All required submittals and demonstrations for operation and maintenance of the project.

.7 Supply of as-built drawings, and operation and maintenance manuals.

.8 Start-up and commissioning of specified components complete with start-up supervision and instruction to the Owner's personnel to effectively operate the building systems to the satisfaction of the Consultant.

.9 Attendance at all project meetings, including pre-construction, interim construction, substantial performance, total performance, and warranty inspections.

.10 Timely submittal of all required project paperwork, including project schedule and revisions to schedule, price breakdown, payment requests, statutory declaration, inspection testing results, permits, bonding and insurance.

.11 Timely coordination and attendance to required maintenance and warranty work.

.2 Refer to Design Drawings for complete scope of work.

.3 All Work under this Contract includes supply of all materials, labour, equipment, freight, and associated services for the complete construction and commissioning.

1.4 CONTRACT METHOD

.1	Tender Start	March 11, 2025
.2	Contractor Site Visit (Optional)	Coordinate date/time with Owner.
.3	Last Day for Questions	March 27, 2025 at 4:30 PM CST
.4	Last Day for Addenda	April 3, 2025 at 4:30 PM CST
.5	Tender Close	April 10, 2025 at 4:30 PM CST
.6	Project Award	April 14, 2025
.7	Construction Start	May 1, 2025
.8	Substantial Completion	November 30, 2025

1.5 CONTRACT METHOD

.1 Construct Work under stipulated price contract (CCDC 2 - 2020).

1.6 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from the Consultant.

.2 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to the Consultant, in writing, any defects which may interfere with proper execution of Work.

1.7 WORK SEQUENCE

.1 Construct Work to facilitate Owner's expedient return to use.

.2 Coordinate Progress Schedule and co-ordinate with Owner during construction.

.3 Maintain fire access/control.

1.8 CONTRACTOR USE OF PREMISES

.1 Contractor shall coordinate use of premises for Work with Owner to allow:

.1 Owner's regular day to day building operations and maintenance activities.

.2 Coordinate use of premises under direction of the Owner and Consultant.

.3 The Contractor will be able to store tools, material, and equipment on site. Storage space is limited and requires approval from the Facility Manager prior to

storage. The Contractor is responsible for tools, materials, and equipment stored on site and any replacement of tools, material and equipment stored on site will come at no additional cost to the project.

.4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by the Consultant.

.7 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.9 OWNER OCCUPANCY

.1 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage if necessary.

1.10 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Consultant to facilitate execution of work.

.1 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.11 EXISTING SERVICES

.1 Notify, Consultant and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Consultant 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.

.3 Submit schedule to and obtain approval from the Consultant for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.4 Provide temporary services to maintain critical building and tenant systems.

.5 Where unknown services are encountered, immediately advise the Consultant, and confirm findings in writing.

.6 Protect, relocate, or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.7 Record locations of maintained, re-routed, and abandoned service lines.

.8 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.9 The Owner, Project Manager, and Consultant will not be held liable for any loss, damage, delay or claim whatsoever arising from the absence in whole or in part of services not shown on drawings.

1.12 DOCUMENTS REQUIRED

.1 Maintain at job site one copy of each document as follows:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed Shop Drawings.

.5 List of Outstanding Shop Drawings.

.6 Change Orders.

.7 Other Modifications to Contract.

.8 Field Test Reports.

.9 Copy of Approved Work Schedule.

.10 Health and Safety Plan and Other Safety Related Documents.

.11 Other documents as specified.

.12 Notice of Project.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Applications for payments.

.2 Substantial performance procedures.

.3 Release of holdback procedures.

.4 Schedule of values.

1.2 REFERENCES

.1 Owner/Contractor Agreement.

.2 Canadian Construction Documents Committee (CCDC).

.1 CCDC 2 - 2020, Stipulated Price Contract.

1.3 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Make applications for payment on account monthly as Work progresses.

.3 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.4 Submit to Consultant, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.

1.4 SCHEDULE OF VALUES

.1 Refer to CCDC 2.

.2 Make schedule of values out in such form and supported by such evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.

1.5 PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Consultant will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be properly due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 Prepare and submit to Consultant comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work when Work is substantially performed.

.3 No later than 10 days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.4 Consultant shall state date of Substantial Performance of Work in certificate.

.5 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish a reasonable date for finishing Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 After issuance of certificate of Substantial Performance of Work:

.1 Submit an application for payment of holdback amount.

.2 Submit sworn statement that all accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in any way be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.3 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.

.4 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount any sums required by law to satisfy any liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.8 FINAL PAYMENT

.1 Refer to CCDC 2, GC 5.7.

.2 Submit an application for final payment when Work is completed.

.3 Consultant will, no later than 10 days after receipt of an application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.

.4 Consultant will issue final certificate for payment when application for final payment is found valid.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Attend project meeting throughout the progress of the work at the call of the Project Manager.

.2 Construction progress meeting frequency to be discussed at the Construction Start-Up meeting. Schedule and administer project meetings throughout the progress of the work at the call of the Consultant.

.3 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Upon award of Contract, the Project Manager will call for a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Representatives of Consultant, Facility Manager, Project Manager, Contractor, and major Subcontractors will be in attendance.

.3 Agenda to include:

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

.2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

.3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.7 Owner provided products.

.8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

.11 Monthly progress claims, administrative procedures, photographs, hold backs.

.12 Appointment of inspection and testing agencies or firms.

.13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 Frequency of meetings to be established at Pre-Construction meeting.

.2 Contractor, major Subcontractors involved in Work, Consultant and Owner are to be in attendance.

.3 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide a five-day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by the Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

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

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately (10) working days, to allow for progress reporting.

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Consultant within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Consultant within (5) working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.1 Total Completion by December 31, 2025.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work.

.2 Consultant will review and return revised schedules within (5) working days.

.3 Revise impractical schedule and resubmit within (5) working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.

.2 Shop Drawings, Samples.

.3 Permits.

.4 Mobilization.

.5 Demolition.

.6 Electrical.

.7 Demobilization.

.8 Substantial Completion.

.9 Total Completion.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays, and impact with possible mitigation.

1.8 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 PRECEDENCE

.1 Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 01 79 00 – Demonstration and Training

.4 Section 01 78 00 – Closeout Submittals

1.4 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract

ADMINISTRATIVE

.2 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.3 Do not proceed with Work affected by submittal until review is complete.

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

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

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

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

.8 Verify field measurements and affected adjacent Work are co-ordinated.

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

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

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

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Refer to CCDC 2 GC 3.11.

.2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.3 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Allow 7 days review of each submission by the Consultant.

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

.7 Make changes in shop drawings as the Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.

.8 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.9 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

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

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.10 After Consultant's review, distribute copies.

.11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as the Consultant may reasonably request.

.12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by the Consultant.

.1 Report signed by authorized official of testing laboratory that material, product, or system identical to material, product, or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.14 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by the Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.15 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by the Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.16 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by the Consultant.

.17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.18 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Consultant.

.19 Delete information not applicable to project.

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

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

.22 Submit hard copies of submittals as requested by the Consultant or Project Manager.

1.6 SAMPLES

.1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Consultant's office.

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

.4 Where colour, pattern or texture is a criterion, submit full range of samples.

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

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

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.7 PHOTOGRAPHIC DOCUMENTATION

.1 Progress photographs to be electronically formatted and labelled as to the location and view. Photographs to be provided on a weekly basis.

1.8 SHOP DRAWING REVIEW

.1 The review of shop drawings by the Consultant is for the sole purpose of ascertaining conformance with the general concept. The review shall not mean that the Consultant approves the detailed design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting the same, and such review shall not relieve the Contractor of the responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract Documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains to fabrication processes or

to techniques of construction and installation and for coordination of the work of all sub-trades.

1.9 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Health and safety considerations required to ensure that Contractors show due diligence towards health and safety on construction sites to meet the requirements laid out in the Occupational Health and Safety Act.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 41 00 – Regulatory Requirements

.3 Section 02 81 00 – Hazardous Materials

1.3 REFERENCE STANDARDS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Province of Ontario

.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Updated 2005.

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

.4 Material Safety Data Sheets (MSDS)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site-specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit site specific safety plan including all relevant elements contained in the Appendix.

.3 Submit electronic copies of Contractor's authorized representative's work site health and safety inspection reports to Consultant's as required.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports. Notify BGIS HS&E and PM immediately in case of incident or accident.

.6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 00 - Hazardous Materials.

.7 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor.

.8 Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to the Consultant.

.10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.5 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

.2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex.

.3 Contractor shall agree to install proper site separation and identification to maintain time and space at all times throughout life of project.

1.6 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.7 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative and Consultant prior to commencement of Work.

1.8 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.9 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.10 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

.3 Contractor shall be the Principal Contractor as described in the Quebec Act Respecting Health and Safety code for the Construction for only their scope and areas of work as defined and described this project specification.

.4 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.11 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

.2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.

.3 Comply with Occupational Health and Safety Regulations, 1996.

.4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.

.5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.12 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Safety Officer, Health and Safety co-ordinator, and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.

1.13 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent, and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with the Work.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily, and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and be under direction of the site supervisor.

1.14 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices, and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.

1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

.2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from the Consultant.

1.17 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for the Work.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 Generals

1.1 RELATED REQUIREMENTS

.1 Section 01 35 29.06 – Health and Safety Requirements

.2 Section 01 41 00 – Regulatory Requirements

1.2 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020 Stipulated Price Contract.

1.3 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets.

.2 Submit electronic copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 FIRES

.1 Fires and burning of rubbish on site is not permitted.

.2 Provide supervision, attendance and fire protection measures as directed.

1.6 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as indicated.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 meters minimum.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

1.7 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures where directed by the Consultant.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.8 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by the Consultant.

.1 Act only after receipt of written approval by the Consultant.

.3 Consultant will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions shall be granted or equitable adjustments allowed to the Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are; or become, in force during performance of Work.

1.2 RELATED REQUIREMENTS

.1 Section 02 81 00 – Hazardous Materials

1.3 REFERENCES TO REGULATORY REQUIREMENTS

.1 Perform Work in accordance with Ontario Building Code and National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code

.1 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.4 HAZARDOUS MATERIAL DISCOVERY

.1 Should hazardous materials be encountered in course of demolition work in areas not identified in HMIS and Testing reports provided in the Appendix, immediately stop work and notify Consultant.

.2 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Consultant.

.3 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Consultant.

.4 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Consultant.

1.5 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Except as otherwise specified, Constructor shall apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:

.1 Regulatory requirements and fees in force on date of Bid submission, and

.2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

1.3 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.4 INSPECTION

.1 Refer to CCDC 2, GC 2.3.

.2 Allow Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Consultant's instructions, or law of Place of Work.

.4 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.5 Consultant will order part of Work 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 cost of examination and correction.

1.5 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by Consultant for purpose of inspecting and/or testing portions of Work.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Consultant at no cost to the Consultant or Owner. Pay costs for retesting and reinspection.

1.6 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.7 PROCEDURES

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

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

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

1.8 REJECTED WORK

.1 Refer to CCDC, GC 2.4.

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

.3 Make good other Contractor's work damaged by such removals or replacements promptly.

.4 If in opinion of the Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by the Consultant.

1.9 REPORTS

.1 Submit electronic copies of inspection and test reports to the Consultant.

.2 Provide copies to manufacturer or fabricator of material being inspected or tested or subcontractor of work being inspected or tested.

1.10 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by the Consultant and may be authorized as recoverable.

1.11 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to the Consultant.

.3 Prepare mock-ups for Consultant's review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Mock-ups may remain as part of Work.

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 52 00 – Construction Facilities

.2 Section 01 56 00 – Temporary Barriers and Enclosures

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.4 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 WATER SUPPLY

.1 Owner will provide continuous supply of potable water for construction use.

.2 Owner will pay for utility chargers at prevailing rates.

1.1 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance, and fuel.

.2 Construction heaters used inside building must be vented to outside or be flameless (vent free) type. Solid fuel salamanders are not permitted.

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

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees Celsius in areas where construction is in progress.

.5 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 manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Owner will pay utility charges when temporary heat source is the existing building equipment.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 TEMPORARY POWER AND LIGHT

.1 The Contractor may use power and water at the building; however, use of such facilities cannot interrupt or affect the tenant's operations. Should operations be affected, the Contractor will be required to provide and pay for temporary power and water during for the remainder of the construction period.

.2 Temporary power for electric cranes and other equipment requiring more than above is responsibility of Contractor.

.3 Connect to existing power supply in accordance with Ontario Electrical Safety Code.

.4 The Contractor shall provide temporary lighting throughout the Braun Building basement, main and second floor corridors, as well as select pedestrian tunnels, through construction.

.5 Temporary lighting shall be provided via portable ceiling-mounted light fixtures and must provide a minimum light level of 1 foot-candle at the floor.

.6 Provide power to temporary light fixtures from nearest suitable source.

.7 Contractor to pay for all installation, maintenance and removal costs.

.8 Contractor to coordinate exact temporary lighting scheme with Owner.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone and internet hook up, necessary for own use.

1.8 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction, governing codes, regulations, and bylaws.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

Not Used

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 56 00 – Temporary Barriers and Enclosures

1.2 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.3 CSA Group (CSA)

.1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-0121-M1978(R2003), Douglas Fir Plywood.

.3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.

.4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

.4 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Indicate use of supplemental or other staging area.

.3 Provide construction facilities to execute work expeditiously.

.4 Remove from site all such work after use.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain ramps, platforms, ladders, scaffolding and temporary stairs.

1.6 HOISTING

.1 Provide, operate, and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists cranes to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

.1 Refer to CCDC 2, GC 3.12.

.2 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.3 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work. Exact parking locations to be coordinated with Owner.

.2 Provide and maintain adequate access to project site.

.3 Clean runways and taxi areas where used by Contractor's equipment.

1.9 OFFICES

.1 Site office can be provided at Contractor's discretion. Coordinate site office location and requirements with Owner.

.2 Provide marked and fully stocked first-aid case in a readily available location.

1.10 EQUIPMENT, TOOL, AND MATERIALS STORAGE

.1 Provide and maintain, in 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 manner to cause least interference with work activities.

1.11 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.12 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by the Consultant.

.2 Protect travelling public from damage to person and property.

1.13 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Fire Routes.

1.2 RELATED SECTIONS

.1 Section 01 52 00 – Construction Facilities

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CSA Group (CSA)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.4 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.5 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around open edges of roofs.

.2 Provide as required by governing authorities.

1.6 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.9 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.10 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant locations and installation schedule 10 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 RELATED SECTIONS

.1 Section 01 73 03 - Execution.

1.3 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

.2 Within text of each specifications section, references may be made to reference standards.

.3 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.4 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.

.5 Cost for such testing will be born by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.4 QUALITY

.1 Refer to CCDC 2.

.2 Products, materials, equipment, and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.3 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.4 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.5 Should disputes arise as to quality or fitness of products, decision rests strictly with the Consultant based upon requirements of Contract Documents.

.6 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.7 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.6 Remove and replace damaged products at own expense and to satisfaction of the Consultant.

.7 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Unload, handle, and store such products.

1.8 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with the Consultant, whose decision is final.

1.10 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves, and accessories.

1.11 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Consultant if there is interference. Install as directed by the Consultant.

1.12 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Refer to CCDC 2 and Section 01 73 03 - Execution Requirements.

.3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.14 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour, and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.15 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of the Consultant.

1.17 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate, or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work

.2 Individual product Sections: cutting and patching incidental to work of section. Advance notification to other sections required.

1.3 SUBMITTALS

.1 Submit written request in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 Work of Owner or separate contractor.

.2 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed Work, and products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on Work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.4 MATERIALS

.1 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.5 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which may be exposed by work.

1.6 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Uncover Work to install ill-timed Work.

.3 Remove and replace defective and non-conforming Work.

.4 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.5 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.6 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.7 Restore work with new products in accordance with requirements of Contract Documents.

.8 Fit work weather or airtight as required to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.9 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with ULC rated fire stopping material as per manufacturer's recommendations.

.10 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.11 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 RELATED REQUIREMENTS

.1 Section 01 77 00 – Closeout Procedures

1.3 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.4 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Consultant. Do not burn waste materials on site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only.

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

.5 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.

.6 Remove waste materials and debris from site at end of each working day.

.7 Dispose of waste materials and debris at designated dumping areas off site.

.8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.5 FINAL CLEANING

.1 Refer to CCDC 2, GC 3.14.

.2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.3 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.4 Prior to final review remove surplus products, tools, construction machinery and equipment.

.5 Remove waste products and debris including that caused by Owner or other Contractors.

.6 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Consultant. Do not burn waste materials on site.

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

.8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched, or disfigured glass.

.9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

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

.11 Vacuum clean and dust building interiors, behind grilles, louvres, and screens.

.12 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

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

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

.15 Remove dirt and other disfiguration from exterior surfaces.

.16 Clean and sweep roofs, gutters, areaways, and sunken wells.

.17 Sweep and wash clean paved areas.

.18 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.19 Clean roofs, downspouts, and drainage systems.

.20 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.21 Remove snow and ice from access to building.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor's commitment to reduce and divert waste materials from landfill.

1.2 RELATED REQUIREMENTS

.1 Section 01 51 00 – Temporary Utilities

.2 Section 01 52 00 – Construction Facilities

.3 Section 02 81 00 – Hazardous Materials

1.3 REFERENCE STANDARDS

.1 Government of Ontario

.1 A Guide to Waste Audits and Waste Reduction Work Plans for Construction and Demolition Projects.

.2 A Guide to Waste Audits and Waste Reductions Work Plans for Industrial, Commercial and Institutional Sectors.

1.4 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants, or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re modeling operations, repair, and demolition.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.4 Non hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.5 Non toxic: Not poisonous to humans either immediately or after a long period of exposure.

.6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the project site.

.11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:

.1 Solvents in paints and other coatings;

.2 Wood preservatives; strippers and household cleaners;

.3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.

.4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project and ensure that requirements of the Construction Waste Management Plan are followed.

.2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings before starting any Work of the Contract attended by the Owner, Contractor, and affected Subcontractor's to discuss the Contractor's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 – Closeout Submittals.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 RELATED REQUIREMENTS

.1 Section 01 78 00 – Closeout Submittals

1.3 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-2020, Stipulated Price Contract.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Consultant in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Consultant's inspection.

.2 Consultant's Inspection:

.1 Consultant and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted, balanced and fully operational.

.4 Certificates required (project specific): plumbing permit, ESA certificate, commissioning report, TAB report, O&M manual, as-built drawings, and CMMS forms.

.5 Operation of systems: demonstrated to Owner's personnel.

.6 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Consultant and Contractor.

.2 When Work is deemed incomplete according to Consultant or Owner, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: Complete the following items prior to making an application for Certificate of Substantial Performance:

.1 Provide at least two (2) weeks notice for Consultant and Owner to attend a substantial completion inspection.

.2 All new systems must be fully operational.

.3 Consultant declares that no major deficiencies or defects exist, and requirements of Contract are substantially performed.

.4 Training for the Owner's representatives have been completed complete with signed attendance sheet.

.5 Commissioning reports have been submitted.

.6 CMMS forms have been submitted.

.7 Testing reports have been submitted.

.8 O&M manuals have been submitted.

.9 As-built drawings have been submitted.

.6 The Client shall withhold $5,000.00 until O&M manuals and record drawings have been received and accepted as complete.

.7 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.8 Final Payment:

.1 When Consultant and Owner considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 Refer to CCDC 2: when Work deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.

.9 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.5 FINAL CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and systems.

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

.3 Operation and maintenance data.

.4 Spare parts, special tools and maintenance materials.

.5 Warranties and bonds.

.6 Final site survey.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 91 00 - Commissioning.

.4 Section 01 79 00 - Demonstration and Training

1.3 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection with Consultant's comments.

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

.4 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, final copies of operating and maintenance manuals in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

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

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.4 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf [219 x 279] mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide electronic copy of operations and maintenance manual (PDF). Format as per hard copy with title page, table of contents, and section flysheets.

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names,

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on drawings provided by the Consultant.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

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

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

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

.2 Field changes of dimension and detail.

.3 Changes made by change orders.

.4 Details not on original Contract Drawings.

.5 References to related shop drawings and modifications.

.5 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.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records etc. required by individual specifications sections.

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.

.3 Include installed colour coded wiring diagrams.

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

.5 Maintenance Requirements: include routine procedures and guide for troubleshooting; 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.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's 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 manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01450 - Quality Control and 01810 - Commissioning.

.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; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

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; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

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; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

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 manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.12 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, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Consultant will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.
.2 Operating Manual.
.3 Maintenance Manual.
.4 Management Manual.
.5 TAB and PV Reports.

.3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:
.1 Multimedia presentations.
.2 Manufacturer's training videos.
.3 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 3 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:
.1 Implementation of training activities,
.2 Coordination among instructors,
.3 Quality of training, training materials,

.2 Consultant, Commissioning Manager, and Facility Manager will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Facility Manager.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:
.1 Review of facility and occupancy profile.
.2 Functional requirements.
.3 System philosophy, limitations of systems and emergency procedures.
.4 Review of system layout, equipment, components and controls.
.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Inter-Action among systems during integrated operation.

.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 79 00.13 – Demonstration and Training for Building Commissioning

.3 Section 01 91 13.16 – Commissioning Forms

1.3 ACRONYMS

.1 Cx - Commissioning.

.2 O&M - Operation and Maintenance.

.3 PI - Product Information.

.4 PV - Performance Verification.

1.4 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

.2 Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the operation and maintenance manual (OMM).

.3 Effectively train O&M staff.

.3 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet user requirements.

.4 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.5 COMMISSIONING OVERVIEW

.1 Cx to be a line item of Contractor's cost breakdown.

.2 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the renovations are completed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.4 Departmental Representative will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.

.2 Equipment, components and systems have been commissioned.

.3 O&M manual (OMM) received, reviewed and approved.

.4 O&M training has been completed.

1.6 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Consultant to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.7 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing Departmental Representative.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems are complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Consultant.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.8 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Consultant before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.9 SUBMITTALS

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

.1 Submit no later than 4 weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing Departmental Representative for changes to submittals and obtain written approval at least 4 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 4 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.10 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 13.16 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

1.11 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.12 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60 % construction completion stage. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60 % and subsequent Cx meetings and as required.

1.13 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.14 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Departmental Representative to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.15 MANUFACTURER'S INVOLVEMENT

.1 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Consultant.

.2 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.3 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.4 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.5 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.16 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

1.17 EQUIPMENT/SYSTEMS DAMAGE EVALUATION REPORT

.1 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.2 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.18 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.19 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.20 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.21 START OF COMMISSIONING

.1 Notify Consultant and Departmental Representative at least 21 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.22 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.23 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.24 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

.2 Engineer to certify all PV results

.3 Contractor to be present at all tests

1.25 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Consultant within 5 days of test and with Cx report.

1.26 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 50 % of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Departmental Representative.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.

.5 Perform additional commissioning until results are acceptable Departmental Representative.

1.27 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Departmental Representatives approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.28 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.29 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Consultant in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.30 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Consultant.

1.31 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.32 TRAINING

.1 In accordance with Section 01 79 00 – Demonstration and Training.

1.33 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.34 OCCUPANCY

.1 Cooperate fully with Owner representative during stages of acceptance and occupancy of facility.

1.35 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Consultant.

1.36 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10 % of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.37 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

.2 Related Sections:

.1 All divisions.

1.2 INSTALLATION/START-UP CHECKLISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. Supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Commissioning manager. Check lists will be required during Commissioning and will be included in Operations and Maintenance Manual (OMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the OMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Owners Representative approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Commissioning manager or Consultant's approval.

1.5 COMMISSIONING FORMS

.1 Contractor shall fill up the commissioning forms for all systems.

.2 Submit completed forms to the Cx agent and Consultant for review.

.3 Revise items on PV forms to suit project requirements.

.4 PV forms are included in this section.

.5 Commissioning procedure by vary for each generator manufacturer. Contractor to provide generator specific commissioning forms prior to commissioning for consultant review.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Commissioning manager, develop appropriate verification forms and submit to commissioning manager for approval prior to use.

.1 Additional commissioning forms to be in same format as provided by Commissioning manager.

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Consultant provides Contractor project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and witnessed by

.9 Commissioning manager.

.10 Submit immediately after tests are performed.

.11 Reported results in true measured SI unit values.

.12 Provide Commissioning manager with originals of completed forms.

.13 Maintain copy on site during start-up, testing and commissioning period.

.14 Forms to be both hard copy and electronic format.

1.8 LANGUAGE

.1 To suit the language profile of the awarded contract.

Part 2 PRODUCTS

2.1 Cx CHECK SHEET

.1 Refer to attached Cx Check Sheet Form.

Part 3 EXECUTION

3.1 NOT USED

END OF SECTION

COMMISSIONING CHECKSHEETS:

Installation Checklist	Contractor's initials / Date	Commissioning Agent's Initials & Verification Date	Remarks / Comments
EQUIPMENT: ATS	Checked by:		
	Initials:		
	Date:		
New Installations			
New ATS Installed			
ATS operational and power supplied to building and transfers power to generator upon power loss			
Cable connections properly installed and switch in proper position			

EQUIPMENT: Diesel Generator	Checked by:		
	Initials:		
	Date:		
Installation Checklist	**Contractor's initials / Date**	**Commissioning Agent's initials & Verification Date**	**Remarks / Comments**
New Installations			
New Diesel Generator installed			
Mounting system installed and adjusted			
Flex Fuel lines installed			
Fuel lines sized correctly			
Fuel lines correctly routed			
Day tank installed securely			
Fuel transfer pump operating			
Day tank float switch wired to fuel transfer pump			
High- and low-level alarms wired properly			
Diesel fuel supplied			
Exhaust system installed compete with all required connections			
Cooling system installed complete with venting			
Room is properly ventilated			
DC Electrical system installed			
AC Electrical system installed			
Remote start wires connected between controller and ATS			

Generator breaker installed			
Running check complete			
Load bank test complete			
Removals			
Existing generator removed completely and disposed of			

EQUIPMENT: Diesel Generator	Checked by:		
	Initials:		
	Date:		
Performance Checklist	**Contractor's Initials / Date**	**Commissioning Agent's initials & Verification Date**	**Remarks / Comments**
Testing and Verification as per CSA-282 performed by Manufacturer with report			
Closeout Manuals Prepared			
ESA Certificate included in manual			
Installer Warranty Letter included in manual			
Staff Training performed			
System Operational with no troubles			
Generator Specific Commissioning Form			

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 20 00 – Concrete Reinforcing

.2 03 30 00 – Cast-in-place Concrete

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA A23.1-14/A23.2 -14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA O86- 14, Engineering Design in Wood.

.3 CSA O121-17, Douglas Fir Plywood.

.4 CSA O151-17, Canadian Softwood Plywood.

.5 CSA O153-19, Poplar Plywood.

.6 CSA O325.0-16, Construction Sheathing.

.7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.

.8 CSA S269.1- [16], Falsework and Formwork.

.9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701.1-17, Standard for Thermal Insulation, Polystyrene, Boards

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Prepare Shop Drawings in accordance with CSA S269.1 for formwork and falsework.

.3 Submit WHMIS SDS – Safety Data Sheets.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork/falsework as required.

.6 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect formwork from damages.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CAN/CSA O86, CSA O437 Series, CSA O153.

.2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.

.3 Rigid insulation board: to CAN/ULC-S701.

.2 Form release agent: non-toxic, biodegradable, low VOC.

.3 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.4 Falsework materials: to CSA S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels, and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Consultant's approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.7 Fabricate and erect formwork in accordance with CAN/CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.8 Align form joints and make watertight.

.1 Keep form joints to minimum.

.9 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners, joints, unless specified otherwise.

.10 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.11 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 2 days for slab on grade

.2 Remove formwork when concrete has reached 70 % of its 28-day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 10 00 – Concrete Forming & Accessories

.2 03 30 00 - Cast-In-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 No measurement made under this Section.

.1 Include reinforcement costs in items of concrete work in Section 03 30 00.09 – Cast-In-Place Concrete.

1.3 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A283-19, Qualification code for concrete testing laboratories.

.3 CAN/CSA A23.3-19, Design of Concrete Structures.

.4 CSA G30.18-09(R2019), Carbon Steel Bars for Concrete Reinforcement.

.5 CSA G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.6 CSA W186- M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2018, Reinforcing Steel Manual of Standard Practice.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 When Chromate solution used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Consultant before its use.

.3 Submit 2 copies of WHMIS Safety Data Sheet (SDS) in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario of Canada.

.1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.2 Indicate placing of reinforcement and:

1. Bar bending details.
2. Lists.
3. Quantities of reinforcement.
4. Sizes, spacings, locations of reinforcement and mechanical splices of approved by Consultant, with identifying code marks to permit correct placement without refence to structural drawings.
5. Indicate sizes, spacings, and locations of chairs, spaces and hangers.

.3 Detail lap lengths and bar development lengths to CAN/CSA A23.3, unless otherwise indicated.

.4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

.4 Quality Assurance Submittals:

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Mill Test Report: upon request, submit to Consultant certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.3 Upon request submit in writing to Consultant proposed source of reinforcement material.

.4 Upon request submit to Consultant epoxy coating applicator certificates identified in Quality Assurance.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

.4 Handle, transport, store and install epoxy coated reinforcing steel bars to prevent damage to coating. Prevent bar-to-bar abrasion and excessive sagging. Do not drop or drag bars. Store on suitable non-metallic supports. For lifting use nylon lifting slings, padded slings, separators or other means recommended by epoxy coated reinforcing steel supplier.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Consultant.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.

.4 Welded steel wire fabric:

.1 Plain in accordance ASTM A1064/A1064M, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.

.2 Finish:

.1 Galvanized: Fabricated from galvanized wire having Class A coating in accordance with ASTM A641/A641M.

.3 Provide in flat sheets only.

.5 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

.6 Tie wire: 1.5 mm diameter annealed wire.

.7 Mechanical splices: subject to approval of Consultant.

.8 Plain round bars: to CSA G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform Consultant of proposed source of supplied material.

Part 3 Execution

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.

.2 When field bending authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

.2 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1/A23.2.

.3 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 Apply thick even film of mineral lubricating grease when paint is dry.

.4 Prior to placing concrete, obtain Consultant's approval of reinforcing material and placement.

.5 Maintain cover to reinforcement during concrete pour.

.6 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3.4 FIELD TOUCH-UP

.1 Touch-up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 03 10 00 - Concrete Forming and Accessories

.2 03 20 00 - Concrete Reinforcing

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005),

.3 CAN/CSA-G30.18-09(R2014), Billet Steel Bars for Concrete Reinforcement.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.4 Site Quality Control Submittals:

.1 Provide testing results and reports for review by Consultant and do not proceed without written approval when deviations from mix design or parameters found.

.2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - SITE QUALITY CONTROL.

.3 Concrete hauling time: provide for review by Consultant deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.

1.4 QUALITY ASSURANCE

.1 Provide Consultant, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.2 Quality Control Plan: provide written report to Consultant verifying compliance that concrete in place meets performance requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Modifying maximum time limit without receipt of prior written agreement from Consultant and concrete producer as described in CSA A23.1/A23.2 is prohibited.

.2 Deviations submitted for review by Consultant.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.6 SITE CONDITIONS

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5°C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect concrete from drying.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Ensure emptied containers are sealed and stored safely.

.2 Provide appropriate area on job site where concrete trucks can be safely washed.

.3 Divert admixtures and additive materials from landfill to approved official hazardous material collections site.

.4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Prescription: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 MATERIALS

.1 Portland Cement: to CAN/CSA-A3001, Type GU.

.2 Supplementary cementitious materials: with minimum 20% fly ash replacement, by mass of total cementitious materials to CSA A3001.

.3 Water: to CSA A23.1.

.4 Reinforcing Bars: to CAN/CSA-G30.18, Grade 400.

.5 Welded steel wire fabric: to ASTM A185

.6 Pre-moulded joint fillers:

.1 Bituminous impregnated fibre board: to ASTM D1751.

.7 Sealer: proprietary poly-siloxane resin blend.

.8 Other concrete materials: to CSA-A23.1/A23.2.

2.3 MIXES

.1 Performance Method for specifying concrete: to meet Consultant performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier to meet performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Workability: free of segregation, colour variations and surface blemishes.

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: C-2

.2 Compressive strength at 28 days age: 32 MPa minimum.

.3 Intended application: slab on grade.

.4 Coarse aggregate size: 20 mm.

.5 Air Content: 5-8%

.6 Slump: 80mm +/- 10mm

.4 Concrete supplier's certification

.5 Provide quality management plan to ensure verification of concrete quality to specified performance.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Consultant's written approval before placing concrete.

.1 Provide 72 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete permitted only after approval of equipment and mix.

.5 Disturbing reinforcement and inserts during concrete placement is prohibited.

.6 Before placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, water stops, joint fillers and other inserts required built in.

.2 Sleeves and openings greater than 100 x 100 mm not indicated reviewed by Consultant.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Consultant before placing concrete.

3.3 FINISHES

.1 Formed surfaces exposed to view:

.1 Slab on grade:

.1 Screed to plane surfaces and use wood floats

.2 Provide round edges and joint spacings using standard tools.

.3 Trowel smooth and provide lightly brushed non-slip finish.

3.4 CONTROL JOINTS

.1 Cut control joints in slab on grade at locations indicated, to CSA-A23.1/A23.2 and install specified joint sealer/filler.

3.5 EXPANSION AND ISOLATION JOINTS

.1 Install pre-moulded joint filler in expansion and isolation joints full depth of slab flush with finished surface to CSA A23.1/A23.2.

3.6 CURING

.1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.7 SEALING APPLICATION

.1 After curing complete, apply poly-siloxane resin blend sealer at $4m^2/L$.

3.8 SURFACE TOLERANCE

.1 Concrete floor slab finishing tolerance to CSA A23.1/A23.2.

3.9 SITE QUALITY CONTROL

.1 Concrete testing: to CSA A23.1/A23.2 by testing laboratory designated by Consultant and paid for by Contractor.

3.10 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate cleaning area for tools to limit water use and runoff.

.4 Cleaning of concrete equipment in accordance with Section 01 35 43 Environmental Procedures.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Conform to Sections of Division 01, as applicable.

.2 Section 26 05 01 shall apply to and govern the work of all Sections of Division 26 as applicable.

1.1 REFERENCE STANDARDS

.1 Canadian Electrical Code (25th edition) 2021.

.2 Ontario Electrical Safety Code (28th edition) 2021.

1.2 SYSTEM DESCRIPTION

.1 Incoming Service Data

.1 Available electric service is 600 volts, 60 Hz, 3 phase, 3 wire.

.2 Coordinate ratings and characteristics of all pertinent electrical equipment to ensure safe and satisfactory operations.

.3 Incoming utilization supply for communication system, signal and television systems is as indicated on Drawings.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with the General Conditions of the Contract and as specified in each section of Division 26.

.2 When equipment and apparatus of one system must be coordinated with or installed in an area with equipment and apparatus of other system(s), prepare and submit necessary coordinated composite drawings for checking interferences.

1.4 AS-BUILT DRAWINGS

.1 Submit "as built" drawings in accordance with the Specifications.

.2 For underground installations, dimension location with respect to building walls and mark levels with respect to elevation of finished floor below where wiring is buried.

.3 Colour code changes using red for additions, and green for deletions.

1.5 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data in accordance with the General Conditions of the Contract and as specified in each section of Division 26.

.2 Review instructions with Owner's Designee to ensure a thorough understanding of equipment and its operation.

1.6 REGULATORY REQUIREMENTS

.1 Materials and workmanship shall be in accordance with the requirements and recommendations of applicable rules, regulations, standards, and codes as specified hereunder. All products shall bear the certification label of CSA, ULC, The Electrical Safety Authority, and the following certifications as applicable.

.1 Canadian Standards Association (CSA)

.2 Underwriter's Laboratories of Canada (ULC)

.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC)

.4 Joint Industrial Council (JIC)

.5 Ontario Building Code (OBC)

.6 Ontario Fire Code (OFC)

.7 Association of Edison Illuminating Companies (AEIC)

.8 American Society for Testing and Materials (ASTM)

.9 Insulated Power Cable Engineers Association (ICEA)

.10 Boards, Service Companies, or other Authorities having jurisdiction.

.2 Permits, Fees, and Certificates: Except as provided in the General Conditions of the Contract, give notices, obtain permits, pay fees required for work of Division 26. Before final certificate of payment is issued by Owner, furnish certificates as evidence that work installed conforms with laws and regulations of all governing authorities. Determine detailed requirements of local authorities having jurisdiction and conform to those requirements.

1.7 QUALIFICATIONS

.1 Work shall be executed by an Electrical Contractor or his designated sub-contractor, holding a valid Contractors' license (Master License).

.2 Work shall be performed by qualified Electricians holding valid Ontario certificates of qualifications.

.3 Work on signal, communication, related control, and other similar systems shall be performed by relevant competent tradesmen.

.4 Electrical testing shall be completed by relevant tradesmen who are qualified, trained, and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner with complete knowledge of the hazards involved.

1.8 PROJECT/SITE CONDITIONS

.1 Examine Site and Contract Documents in accordance with Instructions to Bidders.

.2 Electrical installations in areas classified as hazardous locations, corrosive environments, and other special area application, shall be governed by relevant Industry Standards and Regulatory Requirements.

Part 2 Products

2.1 MATERIALS

.1 Provide a complete electrical system including all materials, equipment, services, and labour necessary as shown or implied for a complete installation.

.2 Inserts: Supply and deliver inserts, anchors, bolts, sleeves, ferrules, and other items to be built into the work of other Divisions, with necessary templates, adequate instructions, and assistance for locating and installing.

.3 Access Panels: For ceilings and/or masonry walls, 12-gauge steel, size 460 mm x 460 mm unless indicated on Drawings, concealed hinges, key-locked type, prime coated, to match ceiling and/or wall finish.

.4 "Lamacoid" Nameplates: 3 mm thick, white capitalized inscribed letterings against black background, sized to accommodate specified nomenclature, as described in other Sections of Division 26, or as indicated on Drawings. Nameplate sizes shall be as follows.

.1	Size 1: 10 x 50 mm	1 line	3 mm high letters
.2	Size 2: 12 x 70 mm	1 line	5 mm high letters
.3	Size 3: 12 x 70 mm	2 lines	3 mm high letters
.4	Size 4: 20 x 90 mm	1 line	8 mm high letters
.5	Size 5: 20 x 90 mm	2 lines	5 mm high letters
.6	Size 6: 25 x 100 mm	1 line	12 mm high letters
.7	Size 7: 25 x 100 mm	2 lines	6 mm high letters

.5 Wall Mounting Panels: 19 mm thick minimum, "Fir" plywood panel, good 1-side painted with 2-coats standard equipment grey colour, cut size to suit, for group-mounting any combinations of surface wall-mounted enclosed disconnect switches and/or circuit breakers, motor starters and/or contactors, small control cabinets or control panels, utility metering cabinets, panelboards, and other similar device enclosures.

Part 3 Execution

3.1 EXAMINATION

.1 Where any parts of systems and/or pieces of equipment are located by dimensions on Drawings, check and verify such dimensions at Site.

.2 Notify Owner's Designee before proceeding further if any discrepancy or interference with other equipment is found which will necessitate revision in or deviation from Work as indicated or specified.

.3 Location of conduit, raceways, wiring and other equipment shall be altered without charge to Owner if so directed by Owner's Designee provided change is ordered before installation, and does not necessitate additional labour and material.

3.2 CUTTING AND PATCHING

.1 Cutting of holes up to 200 mm (8") in diameter and related patching shall be done under Division 26.

.2 Holes and other openings larger than 200 mm (8") in diameter, chases, bulkheads, furring and related patching will be done under Sections whose work is to cut and patch.

.3 Supply measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

3.3 FIRESTOPPING AND SMOKE SEAL

.1 Be responsible for installation of Firestopping and smoke seal inside electrical assemblies (i.e. inside bus ducts).

.2 Firestopping and smoke seals around outside of electrical assemblies, where they penetrate fire rated separations, and Penetration Firestopping shall be carried out under supervision of this Division.

.3 Be responsible for any additional cost incurred as a result of oversizing openings during cutting and patching operation of openings to be fire stopped up to 200 mm (8") in diameter.

.4 Install sheet steel covers and Miscellaneous Metals over temporarily unused sleeves provided in fire separations for future electrical installations.

3.4 INSTALLATION

.1 Verify dimensions of equipment to be installed.

.2 Each room containing electrical equipment and each working space around equipment shall have unobstructed means of egress per OESC Rule 2-310.

.3 Maintain a minimum working space of 1 meter with secure footing about electrical equipment such as switchboards, panelboards, control panels and motor control centers which are enclosed in metal per OESC Rule 2-308.

.4 Protect existing work and equipment during construction.

.5 Co-ordinate electrical requirements for all equipment supplied by owner or other trades. Notify engineer of any conflicts prior to installation.

.6 Instruct and supervise other Sections doing related work.

.7 Electrical products and methods of installation shall be in accordance with relevant Sections of Division 26, and applicable requirements of other Divisions.

.8 Correct installed work as directed by authorized inspector of such authorities.

.9 Notwithstanding the General Conditions of the Contract, no increase to Contract Price shall apply for electrical items relocated from location indicated and prior to installation requiring extra labour and material up to 3 meters (10'-0") from original location, nor will decrease to Contract Price apply where relocation up to 3 meters (10'-0") reduces materials and labour.

.10 Electrical drawings are to be read in conjunction with all other drawings to determine the overall extent of work.

3.5 EQUIPMENT IDENTIFICATIONS

.1 Electrical equipment and auxiliaries shall be identified in accordance with designations indicated on Drawings or as specified in other Sections of Division 26.

.2 Identify electrical equipment, control cabinets, panels, enclosures, switchboards, switchgears, transfer switches, motor control centres, starters, designated boxes, and other similar items, using Lamacoid plates.

.3 Fasten Lamacoid nameplates using self-tapping screws for metal sheet enclosures or glued to PVC or fiberglass construction.

.4 Panelboards shall have Lamacoid plates mounted on top outside trim of door indicating panel identifier, fed from, and voltage.

.5 Disconnect switches and motor starters shall have Lamacoid nameplates mounted on the front cover indicating name of equipment, horsepower,

voltage, and phase.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Transformers: Indicate identifier, capacity, primary and secondary voltages.

.8 Duplex Receptacle Identification: Identify panel and circuit number on all duplex receptacles face plates with black printed lettering on clear labelling tabs (P-tabs).

.9 Terminal boards, blocks, and strips shall have group markers and indexed markers, as applicable.

.10 Mark clearly and permanently all feeder phase identifications at both ends, using standard colour or letter designations.

.11 Identify wiring, as required, using standard indelible wire markers at each termination, in accordance with schematic and/or connection wiring diagrams.

3.6 PAINTING WORK SUPPLIED UNDER DIVISION 26

.1 Touch up minor chips or damage to electrical equipment, installed in this Division, with standard, factory supplied, enamel finish.

.2 Colour code, as specified herein, outlet boxes, pull boxes, junction boxes by applying a small dab of paint to inside of each item during installation.

.3 Colour code, as specified herein, all exposed ducts, conduits, outlet boxes, and similar items by applying a 25 mm (1") wide band of paint around ducts and conduits adjacent to boxes described in above paragraph and on both sides of wall penetration.

.4 Use following paint colour-code:

.1	Red:	Fire Detection and Alarm System
.2	Blue:	Communication System (Voice, Data, Electronics, etc.)
.3	Yellow:	Emergency Power System
.4	Purple:	Security System
.5	Green:	Life Communications System

3.7 PAINTING WORK

.1 Priming and finish painting of exposed unfinished raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items.

.2 Division 26 shall assist in the form of supervision; painting works by other project specifications.

3.8 SYMBOLS

.1 Electrical work is indicated generally on Drawings using standard symbols.

.2 For lighting layout Drawings, letters in a circle indicate the type of fixture to be supplied. Letters and numbers outside and adjacent to circle indicate panel and circuit number.

3.9 MOUNTING HEIGHTS

.1 Measure mounting height dimension from operator's working floor level (finish) to centerline of electrical device or enclosure, unless otherwise indicated or specified herein.

.2 Heights are subject to change to suit structural requirements, and other Site conditions, and therefore as work progresses, and before installing equipment, obtain instructions or directions from Owner's Designee for alternative heights or relocation.

3.10 MOUNTING OF EQUIPMENT

.1 Lighting panels, power panels, annunciators, control panels and cabinets, electrical enclosures, boxes, and other similar items, indicated to be installed in areas with finished walls, shall be flush-mounted and fitted with suitable flush trim and doors.

.2 Lighting panels, power panels, annunciators, control panels and cabinets, electrical enclosures, boxes, and other similar items indicated to be installed in pipe spaces or other areas where an exposed type of wiring is specified shall be surface mounted and fitted with suitable surface mounted covers.

.3 Use wall mounting panel for surface wall group-mounting of electrical control equipment, enclosures, and similar devices as indicated in Drawings, specified herein, or as directed on Site by Owner's Designee.

3.11 GROUNDING

.1 Ground electrical equipment in accordance with requirements of The Electrical Safety Authority Electrical Safety Code.

.2 Arrange grounds so that under normal operating conditions, no injurious amount of current will flow in any grounding conductor. Connect single phase loads so that there is the least possible unbalance of supply.

.3 Grounding equipment to CSA C22.2 No. 41.

.4 Copper grounding conductors to: CSA 22.2 Section 10 latest edition.

.5 For standard duplex receptacles provide insulated ground conductor, size for equipment ground in accordance with electrical code minimum conductor size #12 with green insulation. Ground conductor to be connected under a bonding screw to outlet box(es) and panelboard.

.6 For isolated ground duplex receptacles provide equipment grounding conductor as for standard receptacles and separate insulated ground conductor; size to match line conductors with green insulation and yellow strip. Isolated ground conductor to be connected to isolated ground terminal strip provided in panel.

.7 In panelboard isolated ground bus and equipment ground bus to be tied together with #1/0 insulated conductor.

.8 Install separate "green" ground conductor in same conduit with circuit (power wiring) conductors. Bond securely to ground screw in each outlet, junction, pull box, and equipment enclosure ground conductor equal in ampacity to size of circuit ampacity or in accordance with code for equipment grounding.

.9 Bond single conductor, metallic armored cables to cabinet at supply end, and

provide non-metallic entry plate at load end.

3.12 FIELD QUALITY CONTROL

.1 Trial Usage:

.1 Trial usage by Owner's Designee of any electrical device, machinery, apparatus, equipment, and other work supplied under this Division before final completion and written acceptance by Owner's Designee is not to be construed as evidence of acceptance by Owner.

.2 Owner shall have privilege of such trial usage as soon as Contractor claims that said work is completed, in accordance with Drawings and specifications for such reasonable length of time as Owner's Designee deems sufficient for making a complete test.

.3 No claim for damage shall be made for injury to or breaking of any parts of such tested work, whether caused by weakness or inaccuracy of structural parts or by defective materials or workmanship of any kind whatsoever.

.2 Tests:

.1 Complete testing in accordance with the General Conditions of the Contract and as specified in each section of Division 26.

.2 Voltage provided to equipment in installation shall not exceed minimum and maximum permissible limits for equipment.

.3 Perform insulation tests for installed wiring and equipment with appropriate "Megger" testing equipment. Megger lighting and power circuit feeders and if resistance to ground is less than recommendations on any lighting or power circuit, consider such circuit defective and replace it.

.4 Test performance of equipment for mechanical and electrical defects. Adjust necessary for such equipment. When equipment has been placed in permanent operation give operating personnel all necessary tuition and instructions for its operation and maintenance.

.5 Test conduits which are required to be installed but left empty for clear bore, using ball mandrel, brushes, and snake. Use lignum vitae ball of diameter equal to approximately 85% of conduit inside diameter. Clear any conduit which rejects ball mandrel in an approved manner and without damage thereto.

.6 Furnish labour, materials, instruments and bear other costs in connection with all tests, obtain required certificates of approval, acceptance, and compliance with regulations of agencies having jurisdiction and as specified. Work shall not be deemed complete and final certificate of acceptance will not be issued, until such certificates have been delivered to Owner's Designee.

3.13 CLEANING

.1 Before starting and commissioning operations, install new electrical enclosures, equipment and control devices, open-frame motors shall be air-blown and/or vacuum-cleaned.

.2 Ensure no foreign objects, tools, and materials are left inside switchgears,

cabinets, panelboards, control panels and similar enclosures before such equipment is energized.

.3 Refer to specifications for other applicable final clean-up requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results - Electrical

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18 - 92 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65 -13 Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper and aluminum sized to fit copper and aluminum conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for copper and aluminum conductors.

.2 Clamp for copper conductors.

.3 Clamp for stranded aluminum conductors.

.4 Stud clamp bolts.

.5 Bolts for copper conductors.

.6 Bolts for aluminum conductors.

.7 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results for Electrical.

.2 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3 – 09 (R2014), Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-14, Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 or 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 as indicated.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Single or multi-conductor Teck 90 cables, 1000V insulation, aluminum sheath and overall PVC jacket. Insulation to be 1000V cross-linked polyethylene suitable for installation at a temperature down to minus 40 degrees Celsius. Teck 90 cables to be copper unless otherwise indicated.

.3 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.4 Connectors:

.1 Watertight approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper size as indicated.

.2 Type: AC90 - lead sheath over cable assembly and under armour.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 15 amp, 120 volt receptacle branch circuit home runs shall be minimum #12 AWG. Home runs over 22 meters (75 feet) shall be minimum #10 AWG. Maximum length of branch circuit feeder from panel to furthest receptacle shall be 36 meters (120 feet).

.2 Ensure voltage drop does not exceed 2 percent.

.3 Conductors required for the operation of life safety systems, as described in OESC Rule 46-002, shall be kept entirely independent of all other conductors and equipment and shall not enter luminaire, raceway, box, cabinet or unit equipment occupied by other conductors except where necessary in generator transfer switches, exit signs and emergency lights supplied by two sources, as detailed in OESC Rule 46-108(4).

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Install only in concealed ceiling space for final connection from a junction box or distribution box to luminaries, receptacles and all other electrical devices to a maximum length of 5 meters. AC90 cable shall not be used from distribution or junction boxes to a second junction box.

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Section 26 05 01 - Common Work Results - Electrical

.2 Copper grounding conductors to CSA 22.1 Section 10 latest edition.

.3 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 41-13, Grounding and bonding of equipment.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as indicated or as required to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, Type RW90

.4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermite welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.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, using copper welding by thermite process.

.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 flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.13 Arrange ground so that under normal operating conditions, no injurious amount of current will flow in any grounding conductor. Connect single phase loads so there is the least possible unbalance of supply.

.14 Grounding equipment to: CSA C22.2 No. 41.

.15 Copper grounding conductors to: CSA 22.2 Section 10 (latest edition).

.16 For standard duplex receptacles, provide insulated ground conductor, size for equipment ground in accordance with electrical code; minimum conductor size #12 AWG with green insulation. Ground conductor to be connected under a bonding screw to outlet box(es) and panelboard.

.17 For isolated ground duplex receptacles, provide equipment grounding conductor as for standard receptacles and separate insulated ground conductor; size to match line conductors with green insulation and yellow strip. Isolated ground conductor to be connected to isolated ground terminal strip in panelboard.

.18 In panelboard isolated ground bus and equipment ground bus are to be tied together with #1/0 AWG insulated conductor.

.19 Install separate "green" ground conductor in same conduit with circuit (power wiring) conductors. Bond securely to ground screw in each outlet, junction box, pull box, and equipment enclosure. Ground conductor to be equal in ampacity to size of circuit ampacity or in accordance with code for equipment grounding.

.20 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.3 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections sized as indicated on single line diagram.

3.4 COMMUNICATION SYSTEMS

.1 Install separate #6 AWG insulated ground conductors to each telephone board and to each IT/Lan Rack for connection to voice and data systems.

.2 Confirm #6 AWG insulated ground conductors are approved by system providers prior to ordering.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.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

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Power wiring support channels: U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings.

.2 Communications wiring support channels: Wide-base "J" hook fasteners.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Conform to Section 26 05 01 – Common Work Results-Electrical, as applicable.

.2 Products described herein shall be suitable for dry indoor, non-hazardous area application, unless noted otherwise.

1.2 REFERENCES

.1 CSA C22.2 No. 40 - M1989 (R2014) – Cutout, Junction and Pull Boxes

.2 CSA C22.2 No. 94 - M91 (R2011) - Special Purpose Enclosures

1.3 SUBMITTALS

.1 Submit shop drawings for splitters, pull boxes, and other special enclosures used for mounting control devices and instruments, showing dimensional outline, details of cutouts if required, and mounting lugs or feet and accessories.

Part 2 Products

2.1 FABRICATIONS

.1 Special Purpose Enclosures: CSA C22.2 No. 94, classified in accordance with EEMAC, JIC, and CSA Standards.

.2 Box Covers: Types and sizes to match respective boxes, as required. Provide screwed covers, unless noted otherwise.

.3 Provide approved neoprene gaskets, or applicable sealing materials, in boxes specified for damp, wet, weatherproof/tight, outdoor application, and other areas classified by OESC and other Authorities having jurisdiction.

Part 3 Execution

3.1 INSTALLATION

.1 Size and install boxes, splitters, and enclosures in accordance with applicable section(s) of Ontario Electrical Safety Code (OESC) and manufacturer's recommended installation procedures.

.2 Fasten and support boxes and enclosures independent from raceway supports and ensure rigid installation.

.3 Cut and drill entrance holes into boxes and enclosures for raceways and cutouts as per approved shop drawings on specified special boxes and enclosures.

.4 Install boxes and enclosures so as to be accessible after building is complete, set flush with finished surface where recessed, aligned and levelled where surface mounted.

.5 Use bushing and double locknuts to terminate conduits in metallic sheet boxes with conduit knockouts or drilled holes.

.6 Provide approved hole plugs in unused conduit openings and holes.

.7 Furnish boxes and enclosures with corrosion resistant machine screws.

.8 Boxes and enclosures embedded in concrete for flush-mounting, shall be secured properly with connecting conduits and related works set in place before concrete is poured. Forms, when used, shall be able to be removed without disturbing installed boxes or enclosures.

.9 In general, install boxes and enclosures to suit raceway installation, and location of communication, signal, and electrical equipment, luminaires, and operational requirement, as shown on Drawings.

.10 Provide correct size of openings in boxes for conduit, armoured and non-metallic sheathed cables and terminate with approved connectors or clamps. Do not use reducing washers.

.11 Openings in all electrical metal boxes shall be punched or cut. Burring of holes is not permitted.

.12 Identify source, voltage and load on all junction boxes. Use of indelible marker for these locations is acceptable.

3.2 TESTING AND INSPECTION

.1 Test overall installation using megger instrument for ground continuity after boxes and raceways are completely installed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-2015, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes with two double clamps to take non-metallic sheathed cables.

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.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Conform to Sections of Division 01, as applicable.

.2 Conform to Section 26 05 01 – Common Work Results - Electrical, as applicable.

.3 Conform to Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings, as applicable.

1.2 REFERENCE STANDARDS

.1 CSA C22.2 No. 18-92 (R2003) Outlet Boxes, Conduit Boxes, and Fittings

.2 CSA C22.2 No. 26-1952 Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings

.3 CSA C22.2 No. 40-M1989 (R2009) Cutout, Junction and Pull Boxes

.4 CSA C22.2 No. 45-M1981 (R2012) Rigid Metal Conduit

.5 CSA C22.2 No. 56-04 Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit

.6 CSA C22.2 No. 62-93 Surface Raceway Systems

.7 CSA C22.2 No. 83-M1985 (R2013) Electrical Metallic Tubing

.8 CAN/CSA C22.2 No. 85-M89 Rigid PVC Boxes and Fittings

.9 CSA C22.2 No. 211.2-06 (R2011) Rigid PVC (Unplasticized) Conduit

.10 CSA C22.2 No. 227.1-06 (R2011) Electrical Non-Metallic Tubing

1.3 SUBMITTALS

.1 Provide complete information regarding raceway assembly requirements. Owner will not be responsible for added cost of raceways and changes due to additional manufacturer's requirements.

1.4 QUALITY ASSURANCE

.1 Use only products of one manufacturer for any or combination of packaged-type system such as surface raceways assembly, wireway system, cable trough for tray system.

Part 2 Products

2.1 MATERIALS

.1 Electrical Metallic Tubing (EMT), Couplings and Connectors: CSA C22.2 No. 83.

.2 Rigid Metal Conduits and Fittings: Steel, galvanized heavy wall, CSA C22.2 No. 45.

.3 Flexible Metallic Conduits: CSA C22.2 No. 56.

.4 Liquid-Tight Flexible Metal Conduits: CSA C22.2 No. 56.

.5 Rigid Poly Vinyl Chloride (PVC) Conduits: CSA C22.2 No. 211.2, unplasticized, schedule 40, and Rigid PVC Boxes and Fittings: CAN/CSA C22.2 No. 85.

.6 Outlet Boxes and Fittings: CSA C22.2 No. 18, electro-galvanized sheet steel,

sizes and types in accordance with OESC requirement.

.7 Conduit Boxes and Fittings: CSA C22.2 No. 18, cast-type feraloy, type 'FS' 50mm (2") deep or type 'FD' 70mm (2-3/4") deep, standard factory-threaded hubs or EMT-to-conduit adapters, as required.

.8 Junction Boxes: C22.2 No. 40, galvanized sheet steel construction, with screwed-on covers, and standard knockouts.

.9 Rigid PVC Boxes and Fittings: CAN/CSA C22.2 No. 85.

.10 Box Covers: Types and sizes to match respective boxes and wiring devices as required. Provide screwed covers, unless noted otherwise.

.11 Sizes indicated on Drawings are minimum. Do not reduce without written approval of Owner's Designee.

.12 Use only products of one manufacturer for any or combination of assembled system such as surface raceways assembly, wireway system, and cable tray system.

.13 Accessories:

.1 Pulling cord, polypropylene, 800lb - 2700lb tensile strength, Ideal "Pro-Pull".

.2 Expansion Fittings, weatherproof, with integral bonding assembly.

Part 3 Execution

3.1 EXAMINATION

.1 Raceway runs are indicated diagrammatically on Drawings. Co-ordinate with other Divisions concerned and field-verify routing to check for possible obstruction or interference.

3.2 INSTALLATION

.1 Install raceway systems and boxes complete with appropriate fittings such as connectors, bushings, elbows, couplings, locknuts, expansion fittings, fasteners and supports and accessories supplied as necessary to comply with OESC and other Regulatory Authorities requirements.

.2 Neatly install exposed raceway running parallel to and at right angles to building lines and equally spaced in groups.

.3 Keep raceway ends parallel and on proper spacing to suit knockouts or raceway openings in equipment or enclosure.

.4 Keep raceways at least 150 mm clear of steam pipes, flues, and hot item surfaces. Locate conduits behind infrared or gas fire heaters with 1.5-meter clearance.

.5 Conceal raceways in floor, wall and ceiling construction unless otherwise specified or indicated. Raceways may run exposed in crawl spaces, fan rooms, penthouses, electrical and mechanical rooms. Do not install horizontal runs in masonry walls. Obtain approval from the Owner's Designee prior to installation of any surface raceway in locations other than above specified areas.

.6 Provide expansion couplings, with bonding jumper and ground clamps where

raceways cross building control joints.

.7 Use only metallic, enclosed raceway on installation that required shielding of electrical cables or where installed in ceiling used as return air plenum, as specified or indicated on Drawings.

.8 Raceways shall have established positive low resistance paths to ground and effectively isolate conductors so that any short-circuit arc is confined.

.9 Select appropriate fittings, such as grounding bushings, bonding and grounding straps, to maintain continuity and effectiveness of grounding of raceway system.

.10 Provide necessary fasteners and supports acceptable for type and size of raceways and boxes, to ensure rigid and complete assembly.

.11 Provide suitable inserts or expansion type machine bolts for fastening raceways, fittings, boxes, and equipment to concrete surfaces. Do not use wood screws, lag screws, expansion shields, rawl plugs and nylon inserts.

.12 Secure raceway and other associated work on tile and concrete block walls with approved toggle bolts.

.13 Thoroughly clean raceway and dry clear obstructions before pulling cable or wire.

.14 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.15 Conduits and Tubing:

.1 In general, install power, control, lighting, and signal wirings in EMT, unless otherwise specified herein or indicated on Drawings.

.2 EMT and fittings: Use within the interior of the building for exposed and concealed surface installation not subject to mechanical stress or injury. Use concrete-tight type fittings where used in cast concrete. Provide ground wire for sizes over 50 mm (2").

.3 Rigid metal conduits and fittings: Use where exposed installation is subject to mechanical injury, and other installation as permitted by Authorities having jurisdiction. Use rigid galvanized steel conduit for exterior use.

.4 Flexible metallic conduits: Use for connection to motors, recessed light fixtures, in indoor, dry locations, to maximum lengths as allowed by OESC and other regulatory standards.

.5 Liquid-tight flexible metal conduits: Use for connection to motors, in damp or wet location.

.6 Electrical non-metallic tubing: Use only when specified herein or shown on Drawings, in accordance with OESC and other regulatory standards.

.7 Do not use smaller than 13 mm (1/2") trade size, tubing, conduits, and fittings.

.8 Properly ream conduit ends. Provide necessary fittings, couplings, locknuts, and bushings.

.9 Use only concentric bends. Do not use angle fittings together with bends.

Bends improperly formed not accepted. Do not bend over sharp objects.

.10 Do not install conduits in terrazzo or in concrete toppings.

.11 Concrete-encased conduit connections shall be made concrete tight.

.12 Locate conduit to clear reinforcing steel when installing conduits in cast-in-place concrete.

.13 Protect conduits from damage where they stub out of concrete.

.14 Provide oversized sleeve for conduits passing through waterproof membrane before membrane is installed. Use cold mastic between sleeve and conduit.

.15 Install nylon or propylene fish cord in empty tubing or conduits, fasten cord at both ends and cap.

.16 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.17 Mechanically bend steel conduit over 19 mm diameter.

.18 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.19 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.20 Dry conduits out before installing wire.

.21 Conduit identification: Code with plastic tape or paint at points where conduits enter walls, ceilings, or floors. Apply in 3.0-meter intervals. Refer to Section 26 05 01 – Common Work Electrical.

.16 Boxes and Covers

.1 Install boxes and accessories in accordance with applicable sections of OESC and box manufacturers' recommended installation methods.

.2 Fasten and support boxes and similar enclosures independent from raceway supports.

.3 Set boxes flushed when recessed in finished surface and aligned and levelled when surface mounted. Boxes shall be made accessible after completion of work.

.4 Use bushing and double locknuts to terminate conduit in metallic sheet boxes.

.5 Provide approved hole plugs in unused conduit openings and knockouts.

.6 Supply corrosion-resistant machine screws for boxes and mounting accessories.

.7 Flush-mounted boxes embedded in concrete: Set in-place and secure boxes and respective conduits before pouring concrete. Forms, when used, shall be removable without disturbing installed boxes and raceways.

.8 Surface-mount boxes to suit EMT installation.

.9 Use conduit boxes for surface installation on unfinished wall.

.10 Ensure boxes mounted in ceiling cavities do not interfere with laying-in or removal of ceiling tiles.

.11 Provide correct box opening sizes for conduits and sheathed cables to be terminated with approved clamps or connectors. Do not use reducing washers.

.12 Use square outlet boxes for more than 1 conduit entering one side, and for outlets intended for luminaires.

.13 Use masonry boxes for flush-mounting in block walls; concrete boxes for flush-mounting in concrete walls.

.14 Provide neoprene gaskets in boxes installed outdoor.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

.1 Pressure treated planks with water repellent preservative.

2.2 MARKERS

.1 150mm red "Caution Tape".

Part 3 Execution

3.1 TRENCHING

.1 Excavate trench with suitable machinery to depths and dimensions shown in trench details. Trench details are provided as a guide only. Confirm all depths are compliant with Section 12-012 and Table 53 of the Ontario Electrical safety code.

.2 The minimum cover requirements for electrical cables may be permitted to be reduced by 150mm where mechanical protection is placed in the trench over the underground installation (OESC section 12-012(2)).

.3 Cut and trim sides of trenches evenly and as near vertical as possible and shore as required to prevent cave-in.

.4 Keep bottom of trenches clean and clear of loose material and slope or grade as required.

.5 Sandfill shall be uniformly graded clean sand with a maximum aggregate size of 2.00 mm and maximum of 8% passing the number of 200 sieve.

.6 No covering up or backfilling of electrical equipment shall be performed until the ESA inspector has been notified and permission to cover has been granted as per OESC Rule 2-310.

.7 Backfill trench to the satisfaction of the owner.

3.2 DIRECT BURIAL OF CABLES

.1 Direct buried cables shall be installed so that they run adjacent to each other and do not cross over each other and with a layer of screened sand with a maximum particle size of 4.75mm or screened earth at least 75mm deep both above and below the conductors.

.2 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.

.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 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 Maintain 190 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm vertical or horizontal separation between high voltage cables and communication cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm minimum lateral and vertical separation for communication cables crossing other cables, with communication cables in upper position.

.6 Install treated planks on lower cables 0.6 m in each direction at crossings.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts. Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

.1 Provide 150mm red "caution tape" buried halfway between cable installation and grade level covering the width of cables and or raceways installed. Refer to OESC Rule 12-012(11) and Bulletin 12-2-15.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify 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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.29 -15, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings as noted.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 BREAKERS

.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Symmetrical RMS interrupting capacity as indicated.

.6 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.7 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.8 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.9 Lock-on devices for emergency lighting and fire alarm circuits.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panelboard Size 7 engraved. Nameplate to include;

- Panel identifier
- 'Fed From' location
- Amperage of Feeder (Breaker/Fuse Size)

- Voltage and Phase
- Size of feeder conductor

.3 Nameplate for each circuit in distribution panelboards and switchboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Provide two empty 32mm conduits from each recessed mounted panelboard stubbed into the accessible ceiling space for future wiring.

.7 For multiple section panelboards, provide interconnecting cables from the through-feed lugs in first section to main lugs in 2nd section and terminate. Provide conduit nipple for cross wiring between panelboards as required.

END OF SECTION

Part 1 General

1.1 Intent

.1 It is the intent of these specifications to procure for the owner a generator set, new and to the best industry standard of construction and design. The generator shall be of certified output by the manufacturer. Any major exception to this specification shall be sufficient cause for rejection of bids.

1.2 Rating: Standby

.1 The generator shall deliver its rating continuously for the duration for any normal power failure. This rating is applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. The generator set shall be capable of being operated at rated power until the normal power is restored. The rating will be applied where reliable normal power is available. The standby rated engine shall be sized for a maximum of 85% average load factor and 200 hours of operation per year.

.2 The standby generator set shall be started and accelerated to rated speed immediately upon loss of normal power when equipped with cold starting aids such as a jacket water heater. The generator set shall accept load in one step up to the engine capability to recover to rated speed. Where load conditions are sensitive to voltage and frequency variations, the generator set must be sized accordingly.

1.3 Environment

.1 Altitude: 383 meters

.2 Record Low Temperature: -67 °F / -55.00 °C

.3 Minimum Average Temperature: -16.6 °F / -27.00 °C

.4 Maximum Average Temperature: 77 °F / 25.00 °C

.5 Maximum Temperature: 100 °F / 37.00 °C

.6 Relative Humidity: 0 – 95 percent

.7 The engine generator set shall be capable of producing rated kW and kVA when operating at the above stated altitude and temperature range. The generator manufacturer shall provide data to verify the generator set will operate as required in the specified ambient conditions.

1.4 Submittal Information

.1 Current applicable literature completely describing the engine generator set.

.2 Current applicable literature describing all accessories.

.3 Complete dimensional and electrical drawings locating accessories, anchor bolt and mounting dimensions, fuel, exhaust and cooling piping connections. All information will be coordinated with the installing contractor.

.4 Provide information of the generator intake and exhaust louvers and damper motors. Provide description of how each of these devices are winterized and weatherproofed.

.5 Furnish the following information with the bid:

.1 Engine manufacturer.

.2 Number of cylinders/inline or vee.

.3 Bore and stroke/piston speed @ rated rpm.

.4 Brake Mean Effective Pressure (BMEP) @ rated capacity (kW).

.5 Displacement in cubic inches.

.6 Generator Capacity in kW, kVA and power factor.

.7 NEMA MG1-22.40 temperature rise rating of insulation of generator.

.8 Type of generator exciter.

.9 Certified engine horsepower at the ambient temperature and elevation specified.

1.5 Qualification Data: For Supplier

.1 This generator supplier shall have been regularly engaged in the production of engine-generator sets and associated controls for a minimum of twenty years. Alternate offerings must be submitted for approval 14 days prior to close of bid.

.2 The manufacturer shall provide factory-trained service and parts support through a factory authorized dealer/supplier that is regularly doing business in the area of installation.

.3 Maintenance Proximity: Not more than 5 hours normal travel time from Installer's place of business to Project site.

.4 Manufacturer Qualifications: Maintain within 500 km of Project site a service center capable of providing training, parts and emergency maintenance repairs.

Part 2 Engine and Components

2.1 Starting System

.1 The engine will be equipped with an electric, DC starting motor, positive engagement, of sufficient capacity to crank the engine at starting speed for one minute without overheating.

2.2 Fuel System: Diesel

.1 The fuel storage tank, fittings, gauges and piping shall be supplied and installed by the installing contractor, in accordance with NFPA and applicable local codes and as specified. Flexible fuel connectors shall be supplied to isolate vibration at the engine.

2.3 Cooling System: Unit Mounted

.1 A unit mounted radiator will be furnished complete with a blower fan and glycol coolant. The maximum radiator airflow restriction of 0.5 inches. WC must be taken in account when sizing the cooling system. The cooling system will be sized to maintain a safe engine temperature at the appropriate ambient conditions. Proper ducting must be used to prevent overheating.

.2 Radiator drain plumbed to the skid c/w valve.

2.4 Exhaust System: Critical

.1 The silencer shall attenuate exhaust noise to a Critical level.

.2 An Exhaust silencer shall be furnished of industrial standard construction, all welded, for stationary engine application. A seamless, stainless, convoluted flexible exhaust connector shall be provided. The entire exhaust system and silencer shall be supported independently of the generator set to prevent transmission of vibration and allow for thermal expansion. Long radius, low restriction fittings will be used throughout, and pipe size will be sufficiently large to handle the engine exhaust flow at full load without causing back pressure in excess of that allowed by the engine manufacturer.

2.5 Engine Lubrication System

.1 The engine shall be furnished with a gear type lube pump that will furnish oil under pressure to moving parts.

.2 Full flow lube oil filters shall be provided in addition to a bypass valve that will allow lube oil circulation in the event of a failure of the filtering system.

2.6 Governing System: Isochronous Zero Speed Droop Governing System

.1 The engine generator set shall be provided with a precision electronic governor of the constant speed type. The governor shall be capable of maintaining a steady state bandwidth of not more than ±0.25%, at any constant load, from no load to full load. The governor shall maintain governed speed at 60 Hertz at any load, from no load to full load.

2.7 Battery Specification

.1 AGM batteries manufactured using 99.99% thing plate pure lead technology shall be used. Grids and oxide shall be manufactured from 99.99% pure virgin lead. Spiral wound batteries and batteries using lead-calcium plates are not acceptable. Only the highest purity glass matt separator paper shall be used which shall be highly compressed prior to insertion into the cases to maintain high plate compression. Only analytic grade sulfuric acid shall be used for the electrolyte. The base terminals shall only be tin plated solid brass with stainless steel stud. Batteries shall have a high tolerance to shock and vibration by utilizing internal epoxy bonding techniques. Fully charged batteries shall be capable of storage at 25C for 24 months without top charging and be fully rechargeable. Batteries shall be capable of delivering 400 cycles to 80% DOD. Batteries shall have a design life of 8-12 years in float service and be covered by a full 4 year warranty against factory defects in material or workmanship. Batteries shall not be mounted on vibrating generator base.

2.8 Battery Charger Specification

.1 The battery charger shall be a Transformer based, Industrial-Commercial Heavy-Duty Charger which plugs into a 120V, 15 A straight-blade receptacle. Charger shall not be hard wired.

.2 Battery charger to be located beside the batteries, however it shall not be mounted on the vibrating generator base.

.3 The battery charger shall employ a 3-stage charge program with constant current, constant voltage (with proportional timing) and float-standby charge sequence.

.4 The battery charger shall employ an independent charge override timer to shut down charger if pre-set voltage setting for constant voltage stage is not reached after 18 hours of charging time. Automatic charge re-start on load application.

.5 The battery charger shall employ a charge algorithm to be approved by battery manufacturer with t/2+2Hours timing modification.

.6 The battery voltage shall be determined utilizing AC line zero crossing sample & hold technology.

.7 The battery charger shall employ temperature compensation of the battery charging voltage of -4mV/Cell/Deg C with externally mounted thermistor. Sensor shall not be mounted within the charger case.

.8 A Battery 'Charge Fail Alarm' defined as; Loss of AC Mains Power, Charger internal failure, or Battery disconnect, resulting in the DC Voltage at the charger output falling below 12.8V or above 16.0V for a time duration of more than 1 minute, shall be integrated inside the charger chassis.

.9 The Battery 'Charge Fail Alarm' shall be fed from a power supply independent from the Charge Control Circuit (DC) and contain an independent timing oscillator and voltage reference.

.10 Output Alarm shall be a set of Dry Form 'C' contacts which change state upon Alarm.

.11 The Alarm shall be integrated into the most appropriate building system to annunciate the Alarm condition to building staff.

.12 The Charger shall use L.E.D. Indicators to display charge current & relative % charge status.

.13 The charger shall exhibit a Parasitic Loading of <1mA drain from battery when AC power is off.

2.9 Engine Block Heater:

.1 A jacket water heater shall be provided which will be thermostatically controlled to maintain the engine block at a suitable temperature to assure rapid starting under lowest recorded ambient temperature. The heater will be of the industrial tank type with thermo-syphon circulation.

Part 3 Generator and Components

3.1 Generator Performance Rating

.1 230 kW engine (to ensure engine loading exceeds 30% to avoid wet-stacking)

.2 300 kW alternator (to ensure voltage dip does not exceed 30%)

.3 347/600 Volts

.4 3 Phase

.5 0.8 Power Factor

.6 60 Hertz

.7 1800 RPM

3.2 Mainline Circuit Breaker

.1 A 250 amp, three-pole, 80% rated, electronic trip, LSI type, molded case circuit breaker shall be provided for the protection of the generator.

.2 All circuit breakers shall be listed by Underwriters' Laboratories, Inc., conform to applicable requirements of NEMA Standard Publication No. AB1 and meet appropriate classifications of Federal Specifications W C 37511/Gen.

.3 All circuit breakers shall have a quick-make, quick-break over center toggle-type mechanism and the handle mechanism shall be trip-free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breaker handles shall assume a position between on and off when tripped automatically. Multi-pole circuit breakers shall be common-trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings are to be clearly visible.

3.3 Auxiliary Circuit Breaker – Load Bank

.1 A 300 amp, three-pole, 80% rated, electronic trip, LSI type, molded case circuit breaker shall be provided to facilitate connection of the permanent load bank. Load bank breaker shall be equipped with a shunt trip. In the event that the building requires emergency power during a 100% load test, the ATS shall de-energize the load bank breaker via the shunt trip. ***Note: This is not to occur under normal operation wherein the load bank may supplement building load, but only during a 100% load test.

.2 All circuit breakers shall be listed by Underwriters' Laboratories, Inc., conform to applicable requirements of NEMA Standard Publication No. AB1 and meet appropriate classifications of Federal Specifications W C 37511/Gen.

.3 All circuit breakers shall have a quick-make, quick-break over center toggle-type mechanism and the handle mechanism shall be trip-free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breaker handles shall assume a position between on and off when tripped automatically. Multi-pole circuit breakers shall be common-trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings are to be clearly visible.

3.4 Voltage Regulator: DVR (Digital Voltage Regulator)

.1 The alternator shall be salient-pole, brushless, 4 lead wye, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard - MG1-22.40 and 16.40 - for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The

regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating. The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2. The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.

.2 PMG Excitation System

.1 The generator shall be equipped with a 300/250 Hz permanent magnet generator excitation system. Both the PMG and the rotating brushless exciter shall be mounted outboard of the bearing. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds; or 250% for 50 hertz operation for 10 seconds. The rotating exciter shall use a three phase full wave rectifier assembly with hermetically sealed silicon diodes protected against abnormal transient conditions by a multi-plate selenium surge protector. The diodes shall be designed for safety factors of 5 times voltage and 3 times current.

.3 Voltage Regulator

.1 The DVR2000E voltage regulator shall be a digital, microprocessor design with solid state voltage build-up. No voltage build-up relay or other relays are acceptable. The unit shall be encapsulated for humidity and abrasion protection. The regulator shall include 1/4% regulation, true volts per hertz operation with adjustable cut in, loss of sensing continuity shutdown, over excitation shutdown, three phase RMS sensing, over voltage protection, and provisions for parallel operation.

.4 Performance

.1 The voltage regulation shall be 1/4% from no load to full load and 5% frequency variation. Regulator drift shall be less than 1/2% per 72°F /40°C ambient temperature change. The voltage regulator shall be a static-type using non-aging silicon controlled rectifiers, with electromagnetic interference suppression to MIL-STD-461 C, part 9, when mounted in the generator conduit box. The waveform harmonic distortion shall not exceed 5% total RMS measured line to line at full-rated load. The TIF factor shall not exceed 50. Construction will allow connection to the load through the top, bottom or either side of the conduit box. The conduit box shall be constructed of heavy gauge sheet steel, capable of supporting up to 240 pounds of accessory control equipment. The conduit box shall contain two compartments; one housing the rotating rectifier and PMG; and the other the connection area and regulator. This is to separate the rotating elements from the load connection and voltage regulator adjustments. The regulator shall be mounted on the inside of the conduit box panel allowing access to adjust the regulator through a swinging dust cover from the outside of the conduit box, therefore avoiding the higher voltage generator terminals on the inside of the conduit box.

.5 Verification Of Performance

.1 All certified performance and temperature rise test data submitted by the generator manufacturer are to be the result of the actual test of the same or duplicate generators. Temperature rise data shall be the result of loaded, rated power factor heat runs at the rated voltage and hertz. All performance testing shall be done in accordance with MIL-STD-705 and/or IEEE Standard-115.

3.5 Control Panel

.1 Provide a highly advanced integrated genset control system. Control system to be of rugged construction and microprocessor technology providing genset control, transfer switch control, metering, protection and programmable logic. Control system shall be easy to use, reliable and rugged.

.2 Standard Features

.1 Generator Metering

.2 Engine Monitoring

.3 Genset Control

.4 Emergency Stop

.5 Engine Protection

.6 Windows-Based Software

.7 Automatic Transfer Switch Control

.8 Event Recording

.9 SAE J1939 Engine ECU Communications (Expandable I/O Capability)

.10 Modbus Communications via RS-485

.11 Multilingual Capability (English, Spanish, Chinese)

.12 Extremely Rugged, Fully Encapsulated Design

.13 16 Programmable Contact Inputs

.14 10 Programmable 2 Adc Form A Rated Contacts

.15 Wide Ambient Temperature Range

.16 NFPA110 Compatible

.17 HALT (Highly Accelerated Life Tests) Tested

.18 IP 54 Front Panel Rating with Integrated Gasket

.19 LCD Heater

.20 UL-508 Compatible

.21 UL Recognized, CSA Certified, CE Approved

.22 Current Sensing (5A CT Inputs)

.23 Generator Frequency - 50/60 Hz

.24 Battery Backup for Real Time Clock

.25 Generator Protection (27, 32, 40Q, 59, 81O, 81U)

.26 Generator Protection (47, 51)

.27 Internal Dial-Out Modem (Remote Dial-Out and Dial-In Capability)

.3 Genset Protection

.1 Undervoltage (27)

.2 Reverse Power (32)

.3 Loss of Excitation (40Q)

.4 Overvoltage (59)

.5 Overfrequency (81O)

.6 Underfrequency (81U)

.7 Phase Imbalance (47)

.8 Generator Overcurrent (51)

.9 All Generator Protection features are programmable as alarms, pre-alarms, status or not used.

.4 Engine

.5 Alarms (Shutdown)

.1 Low Oil Pressure

.2 High Coolant Temperature

.3 Low Coolant Level

.4 Low Fuel Level

.5 Overspeed

.6 Overcrank

.7 Engine Sender Unit Failure

.8 Fuel Leak/Fuel Sender Failure

.9 Emergency Stop

.10 Battery Charger Failure

.6 Pre-Alarms (Warnings)

.1 Low Oil Pressure

.2 High Coolant Temperature

.3 Low Coolant Temperature

.4 Battery Overvoltage

.5 Weak Battery

.6 Battery Charger Failure

.7 Engine Sender Unit Failure

.8 Engine kW Overload (3 levels)

.9 Maintenance Interval Timer

.10 Low Coolant Level

.11 Low Fuel Level

.12 Fuel Leak Detect

.13 High Fuel Level

.14 Critical Low Fuel Shutdown

.15 All alarms and pre-alarms can be enabled or disabled via the BESTCOMSPlus PC software or the front panel.

.7 Genset Metering:

.1 Generator parameters consist of 8 standard parameters including, but not limited to voltage, current, Hz, real power (watts), apparent power (VA), and power factor. The view can be programmed to display up to 20 parameters using the scrolling and time delay feature.

.2 Engine parameters include oil pressure, coolant temperature, RPM, battery voltage, fuel level, engine runtime, and various J1939 supported parameters.

.8 Engine Control:

.1 Cranking Control: Cycle or Continuous (Quantity and Duration Fully Programmable)

.2 Engine Cooldown: Smart Cooldown function saves fuel and engine life.

.3 Successful Start Counter: Counts and records successful engine starts

.4 Timers including, but not limited to:

- Engine Cooldown Timer
- Engine Maintenance Timer
- Pre-Alarm Time Delays for Weak/Low Battery Voltage
- Alarm Time Delay for Overspeed
- Pre-Crank Delay
- Continuous or Cycle Cranking Time Delay
- Arming Time Delays after Crank Disconnect:
  - Low Oil Pressure
  - High Coolant Temperature

.9 Event Recording:

.1 The event recorder shall provide a record of alarms, pre-alarms, engine starts, engine runtime loaded, engine runtime unloaded, last run date,

and many other events that are all date and time stamped to help the user determine the cause and effect of issues related to the generator set. The unit shall contain 30 event records each retaining up to 99 occurrences in memory. Time, date and engine hour details shall be available for the most current 30 occurrences within each event record.

.10 Specifications:

.1 Metering:

- Generator Voltage (rms)
- Generator Current (rms)
- Generator Frequency
- Power Factor
- Real Power
- Oil Pressure
- Coolant Temperature
- Fuel Level
- Battery Voltage
- Engine RPM
- Engine Run Time
- Maintenance Timer

.2 Operating Power:

- Nominal: 12 or 24 Vdc
- Range: 6 to 32 Vdc
- Power Consumption: - Sleep Mode: 5W with all relays non-energized
- Power Consumption: - Typical Operational Mode: 14.2W - Run mode, LCD heater on, 6 relays energize
- Battery Ride Through: Withstands cranking ride-through down to 0 V for 50 ms (typical)

.3 Current Sensing: 5 Amps AC Current Sensing

- Continuous Rating .....0.1 to 5.0 Amps AC
- 1 Second Rating.....10 Amps AC
- Burden .....1 VA

.4 Voltage Sensing:

- Range: 12 to 576 V rms, line-to-line
- Frequency Range:10 to 72 Hz for 50/60 style

- Burden: 1 VA
- 1 Second Rating: 720 V rms

.5 Contact Sensing/Input Contacts:

- Contact sensing inputs include 1 emergency stop input and 16 programmable inputs. The factory utilizes up to (3) of these inputs. The emergency stop input accepts normally closed, dry contacts. Provide optional extended run relay for connection of remote e-stop pushbutton beyond 75 feet. All programmable inputs accept normally open, dry contacts.

.6 Engine System Inputs:

- Fuel Level Sensing Resistance Range: 33 to 240 Ω nominal
- Coolant Temperature Sensing Resistance Range: 62.6 to 637.5 Ω nominal
- Oil Pressure Sensing Resistance Range: 34 to 240 Ω nominal
- Engine Speed Sensing: Magnetic Pickup
- Voltage Range: 3 to 35 V peak (6 to 70 V peak-peak)
- Frequency Range: 32 to 10,000 Hz
- Generator Voltage Range: 12 to 576 V rms

.7 Output Contacts:

- 15 Form A Total Programmable Outputs: (3) 30 Adc and (12) 2 Adc
  - The factory typically utilizes (5) on each gen-set which can be reprogrammed as needed:

    (3) 30 Adc for Run, Start and Pre-Start

    (2) 2 Adc for Audible Alarm and Alarm Output

    (10) 2 Adc remain as user-defined outputs

.11 Generator Protection Functions:

.1 Overvoltage (59) and Undervoltage (27)

- Pickup Range: 70 to 576 Vac
- Activation Delay Range: 0 to 30 s

.2 Underfrequency (81U) and Overfrequency (81O)

- Pickup Range: 45 to 66 Hz (50/60 Hz nominal), 360 to 440 Hz (400 Hz nominal)
- Pickup Increment: 0.1 Hz (50/60 Hz nominal), 0.1 Hz (400 Hz nominal)
- Activation Delay Range: 0 to 30 s

.3 Reverse Power (32)

- Pickup Range: –50 to 5%
- Pickup Increment: 0.1%
- Hysteresis Range: 1 to 10%
- Hysteresis Increment: 0.1%
- Activation Delay Range: 0 to 30 s
- Activation Delay Increment: 0.1 s

.4 Loss of Excitation (40Q)

- Pickup Range: –150 to 0%
- Pickup Increment: 0.1%
- Hysteresis Range: 1 to 10%
- Hysteresis Increment: 0.1%
- Activation Delay Range: 0 to 30 s
- Activation Delay Increment: 0.1 s

.5 Environmental:

- Temperature: Operating: -40 to 70°C (-40 to 158°F), Storage: -40 to 85°C (-40 to 185°F)
- Humidity: IEC 68-2-38
- Salt Fog: ASTM B 17-73, IEC 68-2-11 (tested while operational)
- Ingress Protection: IEC IP54 for front panel
- Vibration:
  - 5 to 29 to 5 Hz: 1.5 G peak for 5 min.
  - 29 to 52 to 29 Hz: 0.036" DECS-A for 2.5 min.
  - 52 to 500 to 52 Hz: 5 G peak for 7.5 min.
- Swept over the above ranges for 12 sweeps in each of 3 mutually perpendicular planes with each 15-minute sweep.

.6 Agency Approvals:

- UL/CSA Approvals: "cURus" approved to UL 508 R and CSA C22.2 No.14.
- NFPA Compliance: Complies with NFPA Standard 110, Standard for Emergency and Standby Power.

.7 CE Compliance:

- This product complies with the requirements of the following EC Directives:
  - Low Voltage Directive (LVD) - 73/23/EEC as amended by 93/68/EEC
  - Electromagnetic Compatibility (EMC) - 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
  - EN 50178:1997 - Electronic Equipment for use in Power Installations
  - EN 61000-6-4:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments
  - EN 61000-6-2:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments

.12 Additional Control Panel Accessories

.1 Voltage Adjustment Potentiometer

.2 Frequency Adjust Potentiometer

.3 4 Relay Package

3.6 Remote Annunciator: (SURFACE MOUNTED)

.1 Analog and Digital Remote Annunciator Panels:

.1 Meet NFPA-110 and NEC Section 700-12 requirements

.2 NEMA 1, indoor enclosure (to be mounted in constable's bullpen, per drawings).

.2 Panel Components:

.1 Audible alarm horn rated at 80 db

.2 Surface or flush mounting

.3 Lamp test and alarm silence switches

.4 Analog panel requires 12, 24 volt DC; Digital panel requires 12, volt DC or 120 volt AC power supply input

.5 Conduit box with knockouts on top, bottom, and either side Pre-alarms that can be enabled:

.6 High coolant temperature

.7 Low coolant temperature

.8 Low oil pressure

.9 Low fuel level

.10 Battery over-voltage

.11 Weak battery

.12 Battery failure

.13 Other safety features displayed on panel are display panel on and EPS supplying load.

3.7 Emergency Stop

.1 Three emergency shutdown (red) pushbuttons shall be provided. One emergency shutdown pushbutton shall be located inside the generator at the control panel, one emergency shutdown pushbutton shall be mounted outside the generator enclosure. Provide an additional emergency shutdown pushbutton to be installed in a remote location.

3.8 Base Design

.1 The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment is maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall withstand and mitigate the effects of synchronous vibration of the engine and generator. The base shall be provided with suitable holes for anchor bolts.

3.9 Vibration Isolators

.1 Standard integral rubbers isolators are acceptable for this project. Vibration transmission shall be limited to 2% or better.

.2 On generator sets with two or three-cylinder engines, provide vibration isolators with limit stops to restrict oscillation at starting and stopping.

3.10 Fuel Storage

.1 SUB BASE TANK: 48 hours of operation

.1 Sub-Base skid mounted fuel tank will be supplied.

.2 Sub-Base Tank Construction:

- Be constructed in accordance with Underwriters Laboratories Standard ULC S601
- Be constructed in accordance with Flammable and Combustible Liquids Code, NFPA 30; The Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, NFPA 37; and The Standard for Emergency and Standby Power Systems, NFPA 110.
- Be rectangular in shape.
- Include reinforced steel box channel for generator support, with load rating of 5,000 lbs. per gen-set mounting hole location. Full height gussets shall be provided at gen-set mounting holes.
- Be pressure washed with an iron phosphate solution. Interior shall be coated with a solvent-based film rust preventative, providing inter-operational protection.

- Be shipped with a certificate of Structural/Mechanical Integrity, certifying that it has met standards through rigorous testing and has demonstrated specified capabilities.

.3 Sub Base Tank Testing

- Primary tank sections shall be pressurized at 3-5 psi and leak-checked to ensure integrity of sub base weld seams per ULc-142 standards. Containment basin shall be leak-checked by means of weld penetrant and ultraviolet light.

.4 Sub-Base Tank Fittings

- The sub base tank shall include the following fittings:
- Appropriately sized NPT fuel supply
- Fuel return fitting
- 1-1/4 inch NPT for normal vent
- NPT for emergency vent, sized as appropriate
- 2 inch NPT for manual fill
- NPT for level gauge, sized as appropriate
- 3/8 inch NPT basin drain - tank drain if single wall
- 2 inch NPT for level alarm
- NPT fitting for leak detection alarm

.5 Fuel Level Gauge

- The sub base tank shall include a direct-reading fuel level gauge.

.6 Fuel Fill Alarm

- The fill will come complete with a fill alarm
- Alarm to be mounted outside the enclosure
- Supply high level float switch for alarm
- Supply a spill containment box 3.5 gallon

.7 Fuel Containment Basin

- Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.

.8 Leak Detection System

- A fuel containment basin leak detector switch shall be provided.

.9 Sub Base Tank Venting

- Normal venting:

- Normal venting shall be sized in accordance with the American Petroleum Institute Standard No. 2000, for venting atmospheric and low pressure storage tanks.
- Tank shall be provided with atmospheric - normal - vent cap with screen.
- Normal venting shall be sized as follows:

  1-1/4 inches NPT for tanks through 2,499 gallons

  1-1/2 inches NPT for 2,500 to 3,000 gallons

  2 inches NPT for 3,001 to 10,000 gallons

  Venting will be outside the enclosure.

• Emergency venting:

- The emergency vent NPT fitting shall be sized to accommodate the total capacity of both normal and emergency vents, and is not less than that derived from NFPA 30, Table 2-8, based on wetted surface area of the tank - calculated based on 100% of primary tank.
- A zinc-plated emergency pressure relief vent cap shall be furnished. The vent shall be spring-pressure operated. Opening pressure shall be 0.5 psig; full opening pressure shall be 2.5 psig. Limits shall be marked on top of each vent.
- A second emergency vent fitting shall be provided for the secondary containment portion of the tank if applicable
- Venting will be outside the enclosure.

.10 The contractor shall be responsible to provide fuel for on-site testing and commissioning of the generator and shall provide a full tank of fuel after on-site testing has occurred. All fuel costs are to be included in the tender bid.

3.11 Enclosure: Sound Attenuated Steel Enclosure

.1 The weather protective, sound attenuating enclosure is to be installed at the engine generator set manufacturers facility. Sound level not to exceed 75dBA at 7M.

.2 Weather protective, sound attenuating enclosure Level III. The engine generator set shall be factory enclosed in a 12 gauge steel enclosure constructed with corner posts, uprights and headers. The enclosure shall be sheet steel electro-zinc coated before painting (inside and outside) with a polyester powder rust inhibiting coat. Final colour finish to be selected by Consultant at shop drawing stage.

.3 High corrosion resistance: stainless covered with zinc and made in dichromate, bolts and rivets, anodized aluminum hinges flexible seals between body sections.

.4 Soundfoam between 1" to 2" (25 to 50 mm) acoustical sound treatment.

.5 Large doors to allow easy access to the generator set for servicing and monitoring purposes. Doors to be hinged and removeable for ease of servicing.

.6 Critical silencer mounted inside the enclosure.

.7 Emergency stop button accessible from outside enclosure.

.8 Each door to have lockable hardware with identical keys. Door latches to be flush mounted.

.9 Oil and radiator drains.

.10 Motorized intake damper c/w damper contact and damper fail monitor as per TSSA.

.11 Enclosure heater to meet CSA 282-15 for minimum enclosure temperature.

.12 Step down transformer (where applicable).

.13 Additional Enclosure Accessories:

.1 Lighting

- Lighting consists of two internally mounted powered lights on a switch to illuminate inside of genset enclosure.

.2 Emergency lighting

- Two 12vdc emergency lights complete with a 15 minute timer.

.3 Panelboard

- 240V, 100A rated panelboard shall be provided inside the enclosure to facilitate connection of lighting, block heater, fan forced heater, 120 volt outlet, battery charger and other miscellaneous equipment. The panelboard shall be complete with a 60 amp, 2 pole main breaker.

.4 120 Volt Outlet

- One 120 volt outlet fed from integral generator Panelboard 'G' to be used for servicing of the generator.

.5 Fan Forced Heater

- One 2 kW fan forced heater complete with thermostat fed from integral generator Panelboard 'GEN'.

.6 Starting Reliability

- The design of the unit shall be such that the generator engine will start in all ambient temperature conditions experienced in the town of Rainy River, Ontario (refer to Section 1.3 of this specification).

.7 Rodent Guards

- Enclosure to include rodent guards and skid end caps to prevent animal entry.

3.12 Permanently Installed Load Bank

.1 NEMA 3R rated resistive load bank, screened intake and exhaust hoods, 230 kW, 600 volt, 3 phase, 4-wire, 60 hertz, at unity Power Factor and 5kW step resolution.

.2 Load bank to come equipped with remote load bank controller with manual and automatic step application. Load bank controller to be mounted within generator enclosure, adjacent to generator control panel.

.3 The load bank shall be outdoor weatherproof construction, suitable for installation on a concrete pad or structural base. Enclosure should have mounting legs so it is higher than average snow height. All exterior fasteners shall be stainless steel.

.4 The load bank shall be constructed of heavy gauge powder coated steel.

.5 The main input load bus, load step relays, fuses and blower/control relays shall be located within the load bank enclosure. A thermostatically controlled heater shall be located within the control section to provide protection to the control devices from the effects of moisture and condensation.

.6 Airflow throughout the load bank shall be vertical. Intake openings shall be designed to prevent objects greater than 0.50" diameter from entering the unit.

.7 The load bank exhaust hood shall be angled upward so as to exhaust vertically. The exhaust hood shall be constructed of non-corrosive aluminized steel or aluminum.

.8 The load bank enclosure shall have a baked polyester powder coated finish.

.9 Load elements shall be contained in an integral resistor case. Resistors can be individually removed for inspection or service.

.10 Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through bolt on panels with stainless steel hardware.

.11 Load elements must be fully supported across the entire length within the air stream by segmented ceramic insulators on stainless steel rods. Element supports shall be designed to prevent a short circuit to adjacent elements or to ground.

.12 The overall tolerance of the load bank shall be –0% to +5% kW at rated voltage. A –5%, +5% rating allows the load bank to deliver less than rated kW and shall not be used. The load bank must deliver full rated kW at rated voltage.

.13 The resistors shall not require a cool down period. Failure shutdown of the cooling fan during operation of the resistors shall not shorten their life expectancy.

.14 The load bank shall be cooled by cooling fan blade.The fan motor must be electrically protected against overload.

.15 Load bank should be equipped with Wattmeters, monitoring the output of the generator and the building load.

Part 4 Operation and Maintenance

4.1 Factory Testing

.1 The generator set shall be tested and performance assurance certification shall be completed at the factory on the unit. The test metering shall have an accuracy of 1% or better, and the metering used in testing shall be regularly calibrated and traceable to the National Bureau of Standards. The certified test of the engine-generator performance shall be provided. All tests shall be performed in accordance with the following test methods: IEEE 115 or MIL-STD-705.

.2 Factory tests shall include but not be limited to the following:

- .1 Full load at rated power factor will be applied. Generator shall be rated 0.8PF per item 3.1 and as such should be subjected to a 4 hour load factory test using a reactive load bank set at a power factor of 0.8. **No Exceptions.**
- .2 Full load at unity, 1.0 PF;
- .3 Recordings of the maximum load carrying capabilities of the engine generator set;
- .4 Maximum single block load pickup capability;
- .5 Kilowatts;
- .6 Amperes;
- .7 Voltage;
- .8 Kilovolt amperes;
- .9 Resistance of exciter field and stator;
- .10 Insulation test, generator field, exciter armature, exciter field, generator armature;
- .11 Dielectric test, generator armature, generator field, exciter armature, exciter field;
- .12 Lube oil pressure, if applicable;
- .13 Time;
- .14 Water temperature, if applicable;
- .15 Battery charge rate, if applicable;
- .16 Heaters, jacket water and/or lube oil;
- .17 Safety shutdowns and automatic controls;
- .18 Accessories - annunciator panel, charger, pumps as supplied;
- .19 Phase sequence on three phase;
- .20 Full load and .4PF to verify the motor starting capability of the engine generator set - optional;
- .21 Frequency;

.22 Full rated load at rated PF and maximum load, to verify engine power, overload and maximum capability;

.23 kVA, kilowatts, amperes, voltage, frequency and voltage transients at ½ and rated load frequency at: load, full load rated and maximum output;

.24 Regulator range - adjust, phase sequence, phase voltage balance;

.25 Stator and exciter field resistance;

.26 Insulation test, generator field, exciter armature, exciter field, generator armature or stator;

.27 Dielectric test, generator field, exciter armature, exciter field, generator armature or stator;

.28 All safety shutdown and automatic controls.

.3 Standard testing includes portions of MIL-STD-705:

.1 301.1b: Insulation Resistance Test;

.2 302.1a: High Potential Test;

.3 401.1a: Winding Resistance Test;

.4 410.1a: Open Circuit Saturation Curve Test;

.5 503.1b: Start and Stop Test;

.6 505.2a: Overspeed Protective Device Test;

.7 507.1c: Phase Sequence Test - Rotation;

.8 508.1c: Phase Balance Test - Voltage;

.9 510.1c: Rheostat Range Test;

.10 511.1c: Regulator Range Test;

.11 511.2b: Frequency Adjustment Range Test;

.12 515.1a: Low Oil Pressure Protective Device Test;

.13 515.2a: Overtemperature Protective Device Test;

.14 516.1: Controls, Direction of Rotation;

.15 508.1c: Phase Balance Test - Voltage;

.16 640.1c: Maximum Power Test.

4.2 Startup and Warranty Validation

.1 The start-up of engine generator set shall be performed by authorized service station of the manufacturer. The test will include instruction to personnel of normal maintenance and operation under existing load available.

4.3 Manufacturer's Product Period of Warranty: 2 Year - Basic Standby Limited

.1 The standby electric generating system components, complete engine-generator and instrumentation shall be warranted by the manufacturer against defective materials and factory workmanship. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge. The warranty period shall

commence when the standby system is installed at site. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided.

4.4 Generator Commissioning

.1 General: Upon completion of installation of emergency power supply system, installation shall be tested to ensure conformity to requirements of this Specification.

.2 With engine in a "cold start" condition and emergency load at its normal operating level, a power failure shall be simulated by opening all switches or breakers that supply normal power to building or facility. Test load shall be that load which is normally served by emergency power system.

.3 Operational test shall be continued for 1 h, after which normal power shall be restored to building or facility and satisfactory transfer of load and shutdown of emergency generating set shall be demonstrated.

.4 Following shall be observed and recorded:

.1 time delay on start;

.2 cranking time until the engine starts and runs;

.3 time required to come up to operating speed;

.4 time required to achieve a steady-state condition with all switches transferred to emergency position;

.5 voltage, frequency, and amperes at start-up and at any observed change in load;

.6 engine oil pressure, water temperature where applicable, and battery charge rate at 5 min. intervals for first 15 min. and at 15 min. intervals thereafter;

.7 time delay on retransfer for each transfer switch; and

.8 time delay on engine cool down and shutdown.

.5 Load Test: Generator set shall be subjected to a 4 h 100% load test at factory and on site in compliance with NFPA 110. Once testing is completed, submit test results to the Engineer.

.6 Building load may serve as part or all of test load on site if it is continuous, supplemented by a load bank. Full load shall equal nameplate kW rating of emergency generator set less applicable derating factors for site conditions. A unity power factor is acceptable for onsite testing, provided that rated load tests at rated power factor have been performed by manufacturer of the emergency generator set prior to shipment.

.7 Full load test may be initiated by any method that will start engine and, immediately upon reaching its rated speed, generate full load in one step.

.8 Record all data every 15 min.

.9 Crank cycle shall be repeated a second time to demonstrate that batteries or compressed air have sufficient capacity for a total cranking time of 60 seconds.

.10 Time required to recharge batteries or compressed air shall be demonstrated to meet CSA Standards.

.11 Safety Shutdown and Alarms: Emergency supply shall be tested as recommended by manufacturer to ensure that all safety shutdowns and alarms respond as specified.

.12 Ventilation: During tests demonstrate that ventilating system can maintain the room temperature within allowable tolerances in accordance with CSA Standards.

.13 Instruct plant personnel in operation and service of equipment.

.14 Receive parts, books, manuals, drawings and any spare parts or tools supplied with standby generator plant and handover such items to CBRE Designee at completion and acceptance of installation.

4.5 Load Bank Commissioning

.1 The load bank shall be subjected to a 4-hour, 100% load test with continual monitoring. All test data shall be submitted to the owner and engineer prior to acceptance.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01- Common Work Electrical shall apply to and govern work of all the electrical work, as applicable.

.2 Section 26 05 01 – Common Work Electrical

.3 Section 26 32 14 – Power Generation Diesel

.4 Concrete for electrical work to Section 03 30 00 – Cast-In-Place Concrete.

1.2 SCOPE OF WORK

.1 Supply and installation of a backup emergency generator system to provide emergency backup power for the entire facility. Work to include, but not limited to the following;

.1 Provide backup emergency generator mounted on a concrete pad complete with structural support as required,

.2 Automatic transfer switch

.3 100% rated load bank

.4 Provide remote generator emergency stop pushbutton as indicated,

.5 Provide remote generator annunciator panel(s) as indicated,

.6 All wiring and connections for the equipment mentioned herein.

.2 Provide all equipment, materials, labor and services, not specifically mentioned, which may be necessary to complete all parts of the installation. Ensure that they are in compliance with requirements stated or reasonably inferred by the specifications.

.3 Provide an onsite training session to demonstrate the typical operation of the system upon completion of the work and provide (1) year of technical support to the Owner.

.4 Obtain all regulatory and permitting approvals.

.5 Provide signage for the backup emergency generator system.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with the General Conditions of the Contract and as specified in each section of Division 26.

.2 Provide shop drawings for the generator unit and sub-base fuel tank as described in Section 1.4- Submittal Information of Specification 26 32 14- Power Generation Diesel.

1.4 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data in accordance with the specifications. Make changes or submit additional information if required.

.2 Review instructions with Owner's Designee to ensure a thorough understanding of equipment and its operation.

1.5 REGULATORY REQUIREMENTS

.1 Materials and workmanship shall be in accordance with requirements and recommendations of applicable rules, regulations, standards and codes as specified hereunder. All products shall bear certification label of CSA, ULC, The Electrical Safety Authority, as applicable.

.1 The Electrical Safety Code (OESC)-publication containing Canadian Electrical Code and The Electrical Safety Authority Supplements.

.2 Canadian Standards Association (CSA)

.3 Underwriter's Laboratories of Canada (ULC)

.4 Electrical and Electronic Manufacturers Association of Canada (EEMAC)

.5 Joint Industrial Council (JIC)

.6 Ontario Building Code (0BC)

.7 Ontario Fire Code (OFC)

.8 Association of Edison Illuminating Companies (AEIC)

.9 American Society for Testing and Materials (ASTM)

.10 Insulated Power Cable Engineers Association (ICEA)

.11 Boards, Service Companies or other Authorities having jurisdiction.

1.6 PERMIT, FEES AND CERTIFICATES APPROVAL

.1 Permits, Fees and Certificates: Except as provided in the General Conditions of the Contract, give notices, obtain permits, pay fees required for work of Division 26. Before final certificate of payment is issued by Owner, furnish certificates as evidence that work installed conforms with laws and regulations of all governing authorities. Determine detailed requirements of local authorities having jurisdiction and conform to those requirements.

1.7 QUALIFICATIONS

.1 Work shall be executed by Electrical Contractor or his designated sub-contractor, holding a valid Contractors' license (Master License).

.2 Work shall be performed by qualified Electricians holding valid Ontario certificates of qualifications.

.3 Work on signal, communication, related control and other similar systems shall be performed by relevant competent tradesmen.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Protect equipment during transit, storage and handling to prevent

damage, theft, soiling and misalignment. Coordinate with the Owner for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

1.9 PROJECT/SITE CONDITIONS

.1 Examine Site and Contract Documents in accordance with Instructions to Bidders.

.2 Electrical installations in areas classified as hazardous locations, corrosive environments, and other special area application, shall be governed by relevant Industry Standards and Regulatory Requirements.

Part 2 Products

2.1 GENERATOR MOUNTING SYSTEM

.1 Provide concrete pad to support the backup emergency generator and the sub-base fuel tank.

.2 All exposed edges of concrete are to have a 19mm chamfer.

.3 Drill mounting holes and provide anchor bolts as required for the installation of vibration isolators as required by the manufacturer of the generator unit.

2.2 WIRING

.1 Provide all wiring required for the installation of the backup emergency generator system. All wiring to be sized to conform to Ontario Safety Electrical Code requirements.

2.3 LABELS AND SIGNS

.1 Provide a warning sign installed at the generation connection point stating the generator must have a floating neutral.

.2 All neutral terminations in the system are to be identified with proper signage warning not to disconnect any system neutral when the stand-by system or normal system is operating.

.3 Provide warning labels to be applied onto the main service entrance panelboard all other panelboards. The warning label shall be 5" x 7" laminated vinyl, black on yellow and shall read as follows: "This equipment is backed by an emergency generator"

.4 Provide one label for each of the remote emergency stop pushbuttons. The warning label shall be laminated vinyl, black on yellow and shall read as follows: "Generator Emergency Stop".

Part 3 Execution

3.1 INSTALLATION

.1 Receive, check, unload, store and adequately protect equipment and materials to be installed as part of the standby emergency

generator system. Store in areas as directed by the Owner's representative.

.2 Install materials and equipment in accordance with applicable standards, codes, requirements and recommendations of national, provincial and local authorities having jurisdiction. Install materials and equipment with manufacturers' printed instructions.

.3 Ensure all fasteners are tightened to the appropriate torque as specified by the manufacturer's literature.

.4 Complete concrete work in accordance with Section 03 30 00.

.5 Ground electrical equipment in accordance with requirements of the Ontario Electrical Safety Code.

.6 Install vibration isolators supplied by generator manufacturer. Align generator horizontally and vertically to within ± 0.05 mm, using steel shims where required. Provide machine bolts to secure generator unit to base.

.7 Provide a full tank of fuel oil and any additives as recommended by the generator manufacturer.

.8 Install warning signs as required.

.9 Install remote surface mounted generator annunciator panel supplied by generator manufacturer. The remote generator annunciator panel is to be surface mounted in the MCC room as indicated.

.10 Install one remote emergency stop pushbutton supplied by the generator manufacturer. Provide a surface mounted back box for the emergency stop pushbuttons and locate in the MCC room as indicated.

END OF SECTION

Part 1 General

1.1 Scope

.1 This Specification covers the supply of a complete and fully operational single-sided bypass isolation automatic transfer switch, rated for 250 Amps (minimum), 347/600 Volts, 3 Phase, 4 wire, 60 Hz, in a NEMA type 1 enclosure.

1.2 Basis of Design

.1 Basis of design product: Eaton Breaker-Based Bypass Isolation Automatic Transfer Switch complete with ATC 300+ controller.

.1 Any changes to the automatic transfer switch installation requirements due to the manufacturers' products differing from the Basis-of-Design Product are the responsibility of the Contractor.

1.3 Codes and Standards

.1 The automatic transfer switches and accessories shall conform to the requirements of:

.1 CSA Standards

.2 UL 1008 - Standard for Automatic Transfer Switches

.3 NFPA 70 - National Electrical Code

.4 NFPA 110 - Emergency and Standby Power Systems

.5 IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

.6 NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

.7 NEC Articles 700, 701, 702

.8 International Standards Organization ISO 9001: 2000

Part 2 Products

2.1 Bypass Isolation Switch

.1 The entire enclosed unit shall be rated for 100% continuous load operation without de-rating. The current rating shall be based on all classes of load including resistive and motor loads.

.2 The Bypass Isolation Switch(es) shall be mounted in a separate barriered compartment from the transfer switch. Bypass Isolation Switch(es) that are in a common compartment with a transfer switch shall not be acceptable.

.3 The Bypass Isolation Switch(es) and automatic transfer switch shall be tested and certified as a complete unit and shall be supplied from one manufacturer. The completed assembly shall bear the applicable CSA label.

.4 Fault withstand current rating of the complete assembly shall be minimum 25 kA symmetrical RMS. The interrupting and closing rating shall equal or exceed the required withstand rating. This rating shall be obtained with standard upstream over current protection devices.

.5 The complete assembly shall be mounted in a NEMA 1 enclosure.

.6 All materials and parts used in the unit shall be new, of current manufacture, of best industrial grade, and free from defects and imperfections.

.7 The transfer switch mechanism shall provide a simple means of manual operation using only components which are permanently affixed, in the operating position.

.8 The unit shall permit manual operation of the transfer switch while the system is energized and carrying rated load.

.9 All internal control devices used in the automatic transfer switch shall be cable of being de-energized and isolated from the system by use of an accessible isolation plug for servicing procedures as required.

.10 All power contacts used shall operate in a quick-make / quick-break manner, the speed of which shall be independent of supply voltage and / or speed of operation by manual means.

.11 The Bypass Isolation Switch design shall provide front accessible components for easy serviceability. Power or control connections that are not readily serviceable while the transfer switch is mounted in its enclosure are not acceptable.

Part 3 Functional Requirements

3.1 Automatic Sequence of Operation for Transfer Switch

.1 When the voltage on any phase of the utility supply is below preset levels of rated voltage for a preset time delay, a contact shall close to initiate starting of the generator set.

.2 The load shall transfer to the generator supply when the generator voltage and frequency have reached acceptable preset levels and the warm-up time delay has expired.

.3 When the utility supply is restored to above preset levels of rated voltage on all phases, load transfer from generator to utility supply shall be initiated following expiry of the utility return timer.

.4 Once the transfer mechanism operates and opens the generator power switching device, the transfer mechanism shall stop in the neutral position (i.e. with both power switching devices open) for the duration of the neutral delay timer setting to allow load voltage to decay prior to re-connecting the utility supply.

.5 The load shall be re-connected to the utility supply once the neutral delay timer expires and the transfer mechanism continues operation and closes the utility power switching device.

.6 The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail prior to expiry of the utility transfer delay.

.7 The generator set shall continue to operate following a load transfer for a cool down delay period, and then a contact shall open to stop the generator set.

.8 An "ON LOAD" test mode may be initiated which shall cause a simulated utility failure condition and transfer the load to the generator set. The transfer sequence shall be the same as for a utility power failure except a neutral delay sequence shall occur when transferring from utility to a generator source.

.9 The load shall immediately retransfer to the utility supply (if within acceptable limits) should the generator supply fail during an "ON LOAD" test mode.

3.2 Control Features

.1 The transfer switch shall be rated for use on multiple system voltages. The transfer switch shall be field configurable to operate on the following nominal system voltages; 208V, 240V, 380V, 480V, 600V.

.2 Transfer switch control power must be obtained from the source being transferred to. The controls shall not require any connection to external power sources. Transfer switches requiring power from the engine starting (or other) battery are not acceptable.

.3 The transfer switch controller shall be microprocessor based and shall contain all voltage, frequency sensing and timing functions.

.4 Three phases under voltage sensing shall be provided for the utility supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting.

.5 Single phase under voltage sensing shall be provided for the generator supply. The under voltage sensor shall be user adjustable from 70-95% of nominal and shall be based on a falling (i.e. drop-out) voltage. The under voltage sensor shall be factory set at 85% nominal voltage. The under voltage sensor shall reset (i.e. pick-up) 5% above the dropout setting. The under voltage sensor shall include a transient time delay feature set at 3 seconds.

.6 Under frequency sensing shall be provided for the generator supply to permit load transfer to the generator supply if within nominal limits. The frequency sensing function shall contain a user adjustable set point with a range of 70-90%. The factory setting shall be set at 90% of nominal frequency.

.7 An engine start contact shall be provided which shall close to initiate starting of the engine. The engine start contact shall be rated 5A, 120/240VAC, 5A, 28Vdc resistive.

.8 The Transfer Switch shall be complete with a Group G Controller c/w LCD Display. The controller shall have the following features:

.1 Acc. 1 Time Delay Engine Start - 0-6 Seconds

.2	Acc. 2B	Time Delay Transfer to Emergency - 0 to 60 min 59 sec **NOTE: To be programmed for 15 seconds.**
.3	Acc. 2E	Time Delay Engine Cool down - 0 to 60 min 59 sec
.4	Acc. 3A	Retransfer to Normal - 0 to 60 min 59 sec
.5	Acc. 5	Transfer Test Push Button
.6	Acc. 6B	Retransfer to Normal Time Delay Override
.7	Acc. 7	Engine Start Contact – Qty x 1 Closes to Start
.8	Acc. 9A/B	Pilot Lights Transfer Switch Position - Green (Normal) Red (Emergency)
.9	Acc. 9C/D	Pilot Lights Source Availability - Green (Normal) Red (Emergency)
.10	Acc. 11C	Engine Exerciser – Built In
.11	Acc. 14A/B	Transfer Switch Auxiliary Position Indicating Contact - Qty x 2 Form C Type Per source
.12	Acc. 14Z	Auxiliary Contact when Bypass Not in Auto
.13	Acc. 17	Remote Transfer to Emergency – Requires customer supplied normally open Contact
.14	Acc. 27	In-phase Monitor
.15	Acc. OP1	Controller Output Contacts – Factory set as Feature 31 Pre/Post Transfer Contact

3.3 Mechanically Held Transfer Switch

.1 The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

.2 The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

.3 All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

.4 Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

.5 Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

.6 Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.

.7 Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided. **Provide fully rated neutral terminals with the ATS for future terminations.**

3.4 Microprocessor Controller with Membrane Interface Panel

.1 The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

.2 The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

.3 The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

.1 ANSI C37.90A/IEEE 472 Voltage Surge Test

.2 NEMA ICS - 109.21 Impulse Withstand Test

.3 IEC801-2 Electrostatic discharge (ESD) immunity

.4 ENV50140 and IEC 801 - 3 Radiated electromagnetic field immunity

.5 IEC 801 - 4 Electrical fast transient (EFT) immunity

.6 ENV50142 Surge transient immunity

.7 ENV50141: Conducted radio-frequency field immunity

.8 EN55011: Group 1, Class A conducted and radiated emissions

.9 EN61000 -4 - 11 Voltage dips and interruptions immunity

3.5 Enclosure

.1 The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

.2 Controller shall be flush-mounted display with LED indicators for switch position and source acceptability. It shall also include test and time delay bypass switches.

Part 4 Additional Requirements

4.1 Withstand and Closing Ratings

.1 The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.

4.2 Tests and Certifications

.1 The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

.1 Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

.2 The ATS manufacturer shall be certified to ISO 9001: 2000 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2000.

4.3 Service Representation

.1 The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.3 The designation OPSS refers to Ontario Provincial Standard Specifications.

1.2 REGULATIONS

.1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.

1.3 TESTS AND INSPECTIONS

.1 Before commencing work, conduct condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

1.4 BURIED SERVICES

.1 Before commencing work establish and verify the location of all buried services on and adjacent to the site.

.2 If services are encountered within the extents and depths of the Work, notify the Consultant and do not proceed until written instructions are provided.

.3 Arrange with appropriate authority for relocation of buried services that interfere with execution of work.

.4 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

1.5 PROTECTION

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Consultant's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

Part 2 Products

2.1 MATERIALS

.1 Granular A to OPSS1010.

Part 3 Execution

3.1 Site Preparation

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 CLEARING AND GRUBBING

.1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.

.2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

.3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

3.3 EXCAVATION

.1 Topsoil stripping:

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.

.3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.

.2 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify Consultant when excavations are complete. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Consultant's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.

.3 Excavate for slabs and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 BACKFILLING

.1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.2 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.3 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill.

.4 Placing:

.1 Place backfill, fill and basecourse material in 150 mm lifts. Add water as required to achieve specified density.

.5 Compaction: Compact Granular B to 98% S.P.D.

.6 Under slabs and base support:600 mm Granular B minimum.

.7 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.

3.5 GRADING

.1 Grade so that water will drain away from buildings, walls and paved areas.

3.6 SHORTAGE AND SURPLUS

.1 Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.

.2 Dispose of surplus material off site.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 ASTM A121-07, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.3 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.2 CSA Group (CSA)

.1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA G42-[1964(R1998)], Galvanized (Zinc-Coated) Steel Farm-Field Wire Fencing.

.3 CAN/CSA O80 Series-08, Wood Preservation.

.4 CAN/CSA-Z809-08, Sustainable Forest Management.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fences, gates, posts, and paint and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect fence and gates from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Chain-Link fence:

.1 Must consist of 3.76mm (9 gauge) diameter hot dipped galvanized wire woven into diamond pattern with 50mm spacing. Tensile strength of 55 MPa. Galvanized coating must be minimum 6.1 g/m^2.

.2 Top selvage should be twisted and knuckled; bottom selvage should be knuckled.

.3 Must include 42mm diameter top, middle and bottom rails.

.4 Vertical section of fence is to be 1800mm in height.

.5 Top section of fence is to be completed with single 45-degree arm for three strands of barbed wire angled towards the generator side of the fence. One arm for each post.

.6 Barbed wire: to ASTM A121.

.1 Galvanized steel.

.2 Wire size: 2 mm diameter.

.3 Barbs: 4 point at 125 mm spacing.

.2 Gates:

.1 Frame: to ASTM A53, galvanized steel pipe, standard weight, 42mm outside diameter.

.2 Size: as indicated.

.3 Joints: electrically welded.

.4 Gate Top:

.1 Extend vertical members of gate above top horizontal frame member and provide brace bands to secure wire to extended verticals for three strand barbed wire.

.5 Swing Gate Hardware

.1 Hinges: Manufacturer's heavy duty tamperproof design pivoting hinge mechanism welded to gate posts having thrust capacity of 272 kg. Provide minimum three per gate leaf.

.2 Gate Finish: Hot-dipped galvanized after fabrication in accord with ASTM A123; minimum 610 g/m^2 zinc coating thickness.

.3 Steel posts:

.1 Corner, end, gate and intermediate posts, projection arm with clips, corner and gate post braces, gate posts as indicated.

.2 Post spacing to be no greater than 2400mm.

.3 Galvanizing: zinc coating, minimum 92 g/m^{2}of surface area.

.4 Concrete mixes and materials: to CSA A23.1.

.1 Nominal coarse aggregate size: 20mm.

.2 Compressive strength: 20 MPa minimum at 28 days.

Part 3 Execution

3.1 PREPARATION

.1 Grading:

.1 Level ground along fence line in order to ensure that bottom wire of fence between posts can be maintained at not more than 50 mm above ground.

3.2 ERECTION OF FENCE

.1 Erect fence along lines as indicated Consultant.

.2 Chain-Link Fence Installation:

.1 General: Install fence to comply with ASTM F567. Erect fence in straight lines between terminal posts (corner, end, gate, isolations, pull, or wall posts). Do not begin installation before final grading is complete.

.3 Installation of posts:

.1 Space intermediate posts as indicated.

.2 Space corner, end and gate posts from adjacent post as indicated.

.3 Locate and erect gate posts as indicated.

.4 Install posts true to line and plumb with 1.8 m of post projecting above ground.

.4 Fencing with steel posts:

.1 Install steel posts to depths as indicated.

.2 Set following items in concrete in accordance with Section 2.1

.1 All corner, intermediate and gate posts.

.3 Brace corner, end and gate posts as indicated.

.4 Clamp a studded steel projection arm to each post as indicated.

.5 Erect woven and barbed wire as indicated.

.6 Stretch wires to have uniform tension.

.1 Splice wires with standard wire splices.

.7 Attach wires to posts and projection arms with metal clips approved in writing by Consultant.

3.3 INSTALLATION OF GATES

.1 Install gates in locations as indicated.

.2 Install gates to prevent over-stress on gate posts when gates are open.

.1 Install on level ground with ground clearance of 100 mm maximum.

.3 Locate anchor pipe for drop bolt and install pipe flush with grade surface.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean and trim areas disturbed by operations. Dispose of surplus material [and replace damaged turf with sod as directed by Consultant.

.3 Touch Up:

.1 Clean damaged galvanized surfaces with wire brush removing loose and cracked coatings.

.1 Apply 2 coats of organic zinc-rich coating.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION