Niagara Region
Construction, Energy and Facilities Management
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NIAGARA FALLS COMMUNITY SERVICES OFFICE CEILING AND LIGHTING REPLACEMENT

5853 PEER STREET, NIAGARA FALLS, ON

JULY 2024

DIVISION 01 – GENERAL REQUIREMENTS

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A03 – First Floor Ceiling Plan
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M01 – Mechanical Legend and Notes
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E01 – Electrical Legend, Abbreviations, Notes, Schedule and Details
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END

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Documents

1.1.2 Description of the Work.

1.1.3 Contract method.

1.1.4 Documents provided.

1.1.5 Performance of the Work.

1.1.6 Work sequence.

1.1.7 Phasing

1.2 RELATED SECTIONS

1.2.1 Section 01 78 10 - Closeout Procedures.

1.2.2 This section describes requirements applicable to all Sections and including any specifications on drawings.

1.3 RELATED DOCUMENTS

1.3.1 Agreement, General Conditions and Supplementary Conditions of the Contract.

1.3.2 Region of Niagara General Conditions and Instructions to Bidders.

1.3.3 Other Division 1 specification sections.

1.3.4 This section describes requirements applicable to all Sections.

1.4 WORDS AND TERMS

1.4.1 Refer to and acknowledge other words, terms, and definitions in CCDC-2 Definitions.

1.5 COMPLEMENTARY DOCUMENTS

1.5.1 Drawings, specifications, and schedules are complementary each to the other and what is called for by one shall be binding as if called for by all. Should any discrepancy appear between documents which leaves doubt as to the intent or meaning, abide by Precedence of Contract Documents article below or obtain direction from the Consultant.

1.5.2 Drawings indicate general location and route of services. Install services not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.

1.5.3 Install components to physically conserve headroom, to minimize furring spaces, or obstructions.

1.5.4 Locate devices with primary regard for convenience of operation and usage.

1.5.5 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional work beyond work described to be brought to attention of Consultant.

1.6 PRECEDENCE OF CONTRACT DOCUMENTS

1.6.1 The order of precedence of the Contract Documents shall be as follows:

.1 Contract General and Supplementary Conditions

.2 Specifications

.3 Drawings

.4 Owner's Written Standard Documents

.5 Codes where no requirements exceeding requirements of Codes have been noted in the Contract Documents

1.7 DESCRIPTION OF THE WORK

1.7.1 Remove and dispose of existing t-bar ceilings complete with all associated components in the building.

1.7.2 Provide new t-bar ceilings complete with all associated components.

1.7.3 Remove and dispose of existing supply air diffusers and return grilles as noted in the Contract Drawings.

1.7.4 Provide inspection and cleaning of existing duct work.

1.7.5 Reinstate the remaining existing supply air diffusers into the new t-bar ceiling.

1.7.6 Provide supply air diffusers as noted in the Contract Drawings.

1.7.7 Provide testing, adjusting and balancing of the ventilation systems complete with test report.

1.7.8 Remove and dispose of existing lighting fixtures, lamps, ballasts and accessories in the building. Provide certificate for safe disposal of the lighting fixtures, lamps, ballasts and accessories at an accredited facility.

1.7.9 Provide new lighting fixtures, lighting controls, power wiring, control wiring, conduit and accessories.

1.7.10 Repair surfaces affected by the work to match existing condition.

1.8 WORK SEQUENCE

1.8.1 Construct Work in stages during the construction period, coordinate construction schedule and operations with Owner and Consultant.

1.8.2 Maintain fire access, control of fire protection equipment and operation of the existing fire alarm system. The existing fire alarm system is Edwards Fireshield non-addressable fire alarm system.

1.8.3 During the course of work, the area of work must remain Safe, Clean, secure for occupants, and must be protected from vandalism, fire and damage.

1.8.4 Contractor shall schedule deliveries during times that will not interrupt day to day operations (coordinate with owner). Contractors must be present for and receive all deliveries. The Owner will not receive deliveries on behalf of Contractors and will turn away deliveries if Contractors are not present. The Contractor shall not be

compensated for rescheduling of deliveries that were previously turned away due to absence of the Contractor.

1.8.5 The Contractor shall make provisions so that dust and noise are not emitted outside the area of work. Waste and hazardous materials must be disposed of safely and may not be stored at the site outside the area of work.

1.8.6 The Contractor shall commission the Work in co-ordination with the Owner and in accordance with the requirements of section 01 79 00. The Contractor shall provide all personnel and equipment required to commission the Work and demonstrate the operation of the equipment to the Owner's personnel.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Co-ordination Work with other contractors and work by Owner under administration of Consultant.

1.1.2 Pre-installation and scheduled progress meetings.

1.2 RELATED SECTIONS

1.2.1 Section 01 11 00 - Summary of Work

1.2.2 Section 01 33 00 - Submittal Procedures.

1.2.3 This section describes requirements applicable to all Sections and including any specifications on drawings.

1.3 CO-ORDINATION

1.3.1 Perform co-ordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of others, under instructions of Consultant.

1.4 PROJECT MEETINGS

1.4.1 Schedule and administer weekly project meetings throughout progress of Work as determined by Consultant.

1.4.2 Schedule and administer pre-installation meetings when specified in sections and when required to coordinate related or affected Work.

1.4.3 Prepare agenda for meetings.

1.4.4 Distribute written notice of each meeting four (4) days in advance of meeting date to Consultant.

1.4.5 Provide physical space and make arrangements for meetings.

1.4.6 Preside at meetings.

1.4.7 Record minutes. Include significant proceedings and decisions. Identify action by parties.

1.4.8 Reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants, affected parties not in attendance.

1.5 ON-SITE DOCUMENTS

1.5.1 Maintain at job site, one copy each of the following:

.1 Contract Drawings.

.2 Contract Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 Change Orders.

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved Work Schedule.

.9 Manufacturers' installation and application instructions.

.10 Building Permit and Documents Stamped by the City

.11 Applicable current editions of municipal regulations and by-laws. Current building codes, complete with addenda bulletins applicable to the Place of the Work.

1.6 **SCHEDULES**

1.6.1 Submit preliminary construction progress schedule in accordance to Consultant coordinated with Consultant's project schedule.

1.6.2 After review, revise and resubmit schedule to comply with revised project schedule.

1.6.3 Schedule is to show weekly progress and is to include detailed coordination with the sub- contractor's anticipated progress and a final completion date within the time period stated on the Tender Form.

1.6.4 Changes to the Substantial Performance date are to be recorded by change order with the revised date listed.

1.6.5 Schedule to show dates for submission of shop drawings, material, lists and samples and delivery of a detailed list of equipment and material.

1.6.6 During progress of Work revise and resubmit as directed by Consultant.

1.7 **CONSTRUCTION PROGRESS MEETINGS**

1.7.1 During course of Work schedule progress meetings weekly.

1.7.2 Contractor, major subcontractors involved in Work and are to be in attendance.

1.7.3 Notify parties minimum 5 days prior to meetings.

1.7.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

1.7.5 Minutes to be sequentially numbered. Items to remain from previous meetings until removed by consent of the owner, consultant and contractor.

1.7.6 Challenges to the minutes shall be settled as priority matter under "Old Business" on the agenda.

1.7.7 Agenda to include 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 Review site safety and security issues.

.13 Other business.

1.8 **SUBMITTALS**

1.8.1 Submit preliminary shop drawings, product data and samples for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Consultant.

1.8.2 Submit requests for payment for review, and for transmittal to Consultant.

1.8.3 Submit requests for interpretation/information (RFIs) of Contract Documents, and obtain instructions through Consultant.

1.8.4 Process substitutions through Consultant.

1.8.5 Process change orders through Consultant.

1.8.6 Deliver closeout submittals for review and preliminary inspections, for transmittal to Consultant.

1.9 **REQUESTS FOR INTERPRETATION/INFORMATION**

1.9.1 All Requests for Information (RFIs) shall be submitted to the Consultant with copy to the Owner. Contractor shall submit Request for Information on form with Contractor company letterhead to Consultant and Owner wherever Contractor requires a clarification of the requirements of the Contract Documents or wherever work cannot proceed as indicated by the Contract Documents.

1.9.2 The Contractor shall await the Consultant's response to the RFI before proceeding with the specific work documented in the RFI. No delays to work or submissions of shop drawings not affected by the matter discussed in the RFI shall occur as a result of outstanding responses from Consultant.

1.10 **SITE INSTRUCTIONS**

1.10.1 The Consultant may provide specific instructions on how equipment is to be installed or change the layout arrangement of the arrangement to be installed prior the installation of said equipment. The Consultant will issue these instructions on a Site Instruction

form with the Consultant's company letterhead. Work described by Site Instructions shall not incur additional costs to the Contract.

1.11 **CONTEMPLATED CHANGE NOTICES AND CHANGE ORDERS**

1.11.1 Where equipment or services not indicated in the Contract Documents shall be provided, the Consultant shall issue a Contemplated Change Notice to the Contractor to provide a quotation for provision of the equipment or services.

1.11.2 The Consultant and Owner will review the quotation and if deemed reasonable will produce a Change Order. The Contractor shall provide itemized breakdown of material, equipment, hourly labour rates, number of hours and number of workers for all scopes of work and the same breakdown for all sub-contractor quotations in their quotations.

1.11.3 The Contractor shall not proceed with any work described in a Contemplated Change Notice until a Change Order signed by the Consultant and Owner for the work is received or unless prior approval is provided by the Owner in writing.

1.12 **CO-ORDINATION DRAWINGS**

1.12.1 Provide information required by Consultant for preparation of coordination drawings.

1.12.2 Review and approve revised drawings for submittal to Consultant.

1.13 **CLOSEOUT PROCEDURES**

1.13.1 Notify Consultant when Work is considered ready for Substantial Performance.

1.13.2 Accompany Consultant on preliminary inspection to determine items listed for completion or correction.

1.13.3 Comply with Consultant's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner-occupied areas.

1.13.4 Notify Consultant of instructions for completion of items of Work determined in Consultant's final inspection.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Shop drawings and product data.

1.1.2 Samples.

1.1.3 Certificates and transcripts.

1.2 RELATED SECTIONS

1.2.1 Section 01 78 10 - Closeout Procedures.

1.2.2 Other sections requesting submittals.

1.2.3 This section describes requirements applicable to all Sections and including any specifications on drawings

1.2.4 This section does not cover submissions required for Close-Out, Warranty, and other requirements requested upon completion of the Work.

1.3 ADMINISTRATIVE

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

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

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

1.3.4 Where items or information is not manufactured or produced in Imperial and SI Metric units; convert values for inclusion.

1.3.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

1.3.6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

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

1.3.8 Verify field measurements and affected adjacent Work are coordinated.

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

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

1.3.11 Keep one reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

1.4.1 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.

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

1.4.3 Allow five (5) days for Consultant's review of each submission. Large packages of shop drawings shall be accepted and reviewed in logical stages or parts to accommodate processing of the review for the Consultant within the allowed period.

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

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

1.4.6 Accompany submissions with duplicate 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.

1.4.7 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:
- .1 Subcontractor.
- .2 Supplier.
- .3 Manufacturer.

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

.5 Details of appropriate portions of Work as applicable:
- .1 Fabrication.
- .2 Layout, showing dimensions, including identified field dimensions, and clearances.
- .3 Setting or erection details.

.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to other parts of the Work.

1.4.8 After Consultant's review, distribute copies.

1.4.9 Submit a digital copy in PDF format of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.

1.4.10 Submit a digital copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

1.4.11 Delete information not applicable to project.

1.4.12 Supplement standard information to provide details applicable to project.

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

1.5 **SAMPLES**

1.5.1 Submit for review samples in duplicate as requested in respective specification Sections.

1.5.2 Label samples with origin and intended use.

1.5.3 Deliver samples prepaid to Consultant's business address.

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

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

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

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

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

1.6 **CERTIFICATES AND TRANSCRIPTS**

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

1.6.2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Health and safety considerations required to ensure that the contractor shows due diligence towards health and safety on construction sites, and meets the requirements laid out in Occupational Health and Safety standards.

1.2 RELATED SECTIONS

1.2.1 All other sections forming part of the contract documentation.

1.3 REFERENCES

1.3.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

1.3.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3.3 Province of Ontario

.1 Occupational Health and Safety Act, R.S.O. 1990 current version.

1.4 SUBMITTALS

1.4.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.4.2 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.

1.4.3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to authority having jurisdiction, daily.

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

1.4.5 Submit copies of incident and accident reports.

1.4.6 Submit WHMIS MSDS - Material Safety Data Sheets for any materials used for this project.

1.4.7 Owner’s representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Owner’s representative within 5 days after receipt of comments from Owner’s representative.

1.4.8 Owner’s representative’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.

1.4.9 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 Owner's representative.

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

1.5 **FILING OF NOTICE**

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

1.6 **SAFETY ASSESSMENT**

1.6.1 Perform site specific safety hazard assessment related to project.

1.7 **MEETINGS**

1.7.1 Schedule and administer Health and Safety meeting with Owner's representative prior to commencement of Work.

1.8 **REGULATORY REQUIREMENTS**

1.8.1 Do Work in accordance with federal and provincial regulations. Where federal regulations are more stringent, the more stringent regulations shall be followed.

1.9 **GENERAL REQUIREMENTS**

1.9.1 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.

1.9.2 Owner's representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.10 **RESPONSIBILITY**

1.10.1 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.

1.10.2 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.

1.10.3 Facility personnel will provide a list of chemicals contained in the facility. Any work done by the contractor shall maintain the safety of all persons on site and safety of property on site. If the contractor deems that some products are dangerous, the chemical will be moved by facility personnel in order for the facility employees and contractor employees to remain safe during the course of construction for this project.

1.11 **COMPLIANCE REQUIREMENTS**

1.11.1 Comply with Ontario Health and Safety Act, R.S.O.

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

1.12 **UNFORESEEN HAZARDS**

1.12.1 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 Ontario having jurisdiction and advise Owner's representative verbally and in writing.

1.13 **HEALTH AND SAFETY CO-ORDINATOR**

1.13.1 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 construction.

.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.

1.14 **POSTING OF DOCUMENTS**

1.14.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Ontario having jurisdiction, and in consultation with Owner's representative.

1.15 **CORRECTION OF NON-COMPLIANCE**

1.15.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner's representative.

1.15.2 Provide Owner's representative with written report of action taken to correct non-compliance of health and safety issues identified.

1.15.3 Owner's representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 **BLASTING**

1.16.1 Blasting or other use of explosives is not permitted.

1.17 **POWDER ACTUATED DEVICES**

1.17.1 Use powder actuated devices is not permitted.

1.18 **WORK STOPPAGE**

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

2 PRODUCTS

2.1 NOT USED

Not used.

3 EXECUTION

3.1 NOT USED

Not used.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Laws, notices, permits and fees.

1.1.2 Discovery of hazardous materials.

1.2 RELATED SECTIONS

1.2.1 This section describes requirements applicable to all Sections and including any specifications on drawings

1.3 LAWS, NOTICES, PERMITS AND FEES

1.3.1 The laws of the Place of the Work shall govern the Work.

1.3.2 The Owner shall obtain and pay for the building permit, permanent easements and rights of servitude. The Contractor shall be responsible for permits, licenses or certificates necessary for the performance of the Work which were in force at the date of executing the Agreement.

1.3.3 Give the required notices and comply with the laws, ordinances, rules, regulations or codes which are or become in force during the performance of the Work and which relate to the Work, to the preservation of the public health and to construction safety.

1.3.4 If the Contractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Contractor shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations or codes. Determine detailed requirements of authorities having jurisdiction.

1.3.5 Pay construction damage deposits levied by municipality in connection with the issuance of a building permit.

1.4 HAZARDOUS MATERIAL DISCOVERY

1.4.1 Asbestos: If material resembling asbestos is encountered in course of demolition work, immediately stop work and notify Consultant.

1.4.2 Asbestos and PCB: Any materials, equipment or fixtures encountered that are suspect as to containing PCBs shall be disposed of according to Ontario Regulation 362 – Waste Management - PCBs.

1.5 PERSONNEL SMOKING

1.5.1 Smoking is not permitted within the work area. Comply with regulatory and Owner-imposed smoking restrictions during execution of the Work within or outside the premises.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1.1.1 Section 01 45 00 - Quality Control.

1.1.2 This section describes requirements applicable to all Sections and including any specifications on drawings.

1.2 QUALITY ASSURANCE

1.2.1 Provide the services of and co-operate with testing organization services as specified in Section 01 45 00 - Quality Control.

1.2.2 Testing organization: Current member in good standing of their respective professional or industry organization and certified to perform specified services.

1.2.3 Comply with applicable procedures and standards of the certification sponsoring association.

1.2.4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.2.5 Qualifications:

.1 Provide adequate workforce training through meetings and demonstrations.

.2 Have personnel on site with experience installing infrastructure similar to the infrastructure installed under this project throughout this project for consultation and supervision purposes while work is taking place.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Shop drawings and product data.

1.1.2 Inspection and testing, administrative and enforcement requirements.

1.1.3 Mock-ups.

1.1.4 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

1.2.1 Section 01 43 00 - Quality Assurance.

1.2.2 This section describes requirements applicable to all Sections and including any specifications on drawings

1.3 REFERENCES

1.3.1 ISO/IEC 17025 - General Requirements for the Competence of Testing and Calibration Laboratories.

1.3.2 SCC (Standards Council of Canada).

1.4 INSPECTION BY AUTHORITY

1.4.1 Allow Authorities Having Jurisdiction 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.

1.4.2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.

1.4.3 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.

1.5 REVIEW BY CONSULTANT

1.5.1 Consultant may order any part of Work to be reviewed if Work is suspected to be not in accordance with Contract Documents.

1.5.2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

1.6 ACCESS TO WORK

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

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

1.7 PROCEDURES

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

1.7.2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

1.7.3 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

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

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

1.8.3 Consultant may order any 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.

1.8.4 The Consultant may require testing as part of their examination in accordance with the following requirements:

.1 Independent Inspection/Testing Agencies will be engaged by Consultant for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Consultant.

.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 Consultant at no cost to Consultant. Pay costs for original testing and inspecting borne by Consultant and also retesting and re-inspection.

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

1.9 REPORTS

1.9.1 Submit four (4) paper copies and one (1) electronic copy of signed inspection and test reports to Consultant.

1.9.2 Provide copies to Subcontractor of work being inspected or tested.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

1.1.1 General Conditions

1.1.2 Ontario Building Code (OBC) current edition, including all amendments up to bid closing date.

1.1.3 Province of Ontario Occupational Health and Safety Act and Regulations for Construction Sites: All work shall be in accordance with the latest edition of the Province Of Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

1.1.4 CSA-0121, Douglas Fir Plywood

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

1.2 RELATED SECTIONS

1.2.1 Section 01 43 00 - Quality Assurance.

1.3 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.3.1 Provide construction facilities and temporary controls in order to execute the work expeditiously.

1.3.2 Provide hoarding and dust-tight screens in accordance with the requirements laid out in Section 01 52 00 Paragraphs 1.14.4 and 1.14.5.

1.3.3 Hoarding

.1 Erect temporary enclosures using 38 × 89 mm construction grade lumber framing at 600 mm centres and 1200 × 2400 × 13 mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically as indicated flush and butt jointed.

.3 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.4 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB 1.189 and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.

.5 Provide lockable gates and doors at hoarding for access and egress from work zones.

1.3.4 Dust Tight Screens

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

.2 Provide fastening of the screens from the floor or underside of the structure above as applicable to contain the dust within the work zones and prevent emission of the dust outside the work zones. Repair floors after removal of the hoarding to match the existing surface conditions.

.3 Doors provided in dust-tight screens and hoarding shall open into the work zone.

.4 Provide tarps and sealing over furniture or other possessions of the Owner that Owner allows to remain inside the work zones.

.5 Provide protection for finished and partially finished work and equipment during performance of Work.

.6 Maintain and relocate protection until such Work is complete.

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

.8 Provide necessary screens, covers, and hoardings.

.9 Be responsible and pay for damage incurred due to lack of or improper protection.

1.4 **SITE STORAGE AND LOADING**

1.4.1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with Products.

1.4.2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.

1.5 **SANITARY FACILITIES**

1.5.1 Existing facilities as designated may be used during the construction period.

1.6 **WATER SUPPLY**

1.6.1 The Owner will provide a continuous supply of potable water for construction use. Contractor shall provide temporary water supply for cleaning of site and preparation of final finishes.

1.7 **CONCEALMENT**

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

1.7.2 Before installation, inform the Consultant if there is a contradictory situation. Install as directed by Consultant.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

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

1.1.2 Product substitution procedures.

1.1.3 Manufacturer's instructions.

1.1.4 Quality of Work, coordination and fastenings.

1.2 RELATED SECTIONS

1.2.1 Section 01 62 00 - Product Exchange Procedures.

1.2.2 This section describes requirements applicable to all Sections and including any specifications on drawings

1.3 TERMINOLOGY

1.3.1 New: Produced from new materials.

1.3.2 Re-newed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

1.3.3 Defective: A condition determined exclusively by the Consultant.

1.4 PRODUCT QUALITY

1.4.1 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work: New, or renewed, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.

1.4.2 All products shall be CSA-approved, ULC-approved or cUL-approved and labeled as such.

1.4.3 All products shall be CSA-approved, ULC-approved or cUL-approved for the application for which they are to be installed and used on this project and labeled as such.

1.4.4 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.

1.4.5 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant.

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

1.4.7 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**

1.5.1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.

1.5.2 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.

1.5.3 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 AND PROTECTION**

1.6.1 Store and protect Products in accordance with manufacturers' instructions.

1.6.2 Store with seals and labels intact and legible.

1.6.3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

1.6.4 For exterior storage of fabricated Products, place on sloped supports above ground.

1.6.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

1.6.6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

1.6.7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

1.6.8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.7 **TRANSPORTATION AND HANDLING**

1.7.1 Transport and handle Products in accordance with manufacturer's instructions.

1.7.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

1.7.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.8 **PRODUCT CHANGES**

1.8.1 Change in Product(s): Submit request for substitution or alternative in accordance with Section 01 62 00.

1.9 **MANUFACTURER'S INSTRUCTIONS**

1.9.1 Unless otherwise indicated in the 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.

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

1.9.3 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.

1.10 **FASTENINGS**

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

1.10.2 Prevent electrolytic action between dissimilar metals and materials.

1.10.3 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.

1.10.4 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.

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

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

1.11 **FASTENINGS - EQUIPMENT**

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

1.11.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.

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

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

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Substitutions.

1.1.2 Alternatives or Alternates.

1.2 RELATED SECTIONS

1.2.1 This section describes requirements applicable to all Sections and including any specifications on drawings

1.3 SUBSTITUTIONS/EXCHANGE

1.3.1 The General Conditions specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this Section.

1.3.2 Consultant will consider requests for Substitutions only within fifteen (15) days after date of Owner-Contractor Agreement.

1.3.3 For Specification sections that do not have a 'Base Bid' Products/System or approved alternates and, instead specify performance criteria for the Product or System, the Contractor shall submit their Product or System information in accordance with Section 01 33 00 – Submittal Procedures.

1.3.4 Substitutions may be considered when a specified Product becomes unavailable through no fault of the Contractor.

1.3.5 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

1.3.6 A request constitutes a representation that the Bidder/Contractor:

.1 Has investigated Product proposed for substitution and determined that it meets or exceeds the performance characteristics of the specified Product.

.2 Will provide the same warranty for the Substitution as for the specified Product.

.3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

.4 Waives claims for additional costs or time extension which may subsequently become apparent.

.5 Will reimburse Owner and Consultant for review or redesign services associated with re-approval by authorities.

1.3.7 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.3.8 Substitution Submittal Procedure:

.1 Submit three (3) copies of request for Substitution for consideration. Limit each request to one (1) proposed Substitution.

.2 Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.

.3 The Consultant will notify Contractor in writing of decision to accept or reject request.

2 PRODUCTS

Nil

3 EXECUTION

Nil

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Submittal requirements associated with connecting to existing facilities.

1.1.2 Execution requirements for all Work.

1.2 RELATED SECTIONS

1.2.1 This section describes requirements applicable to all Sections and including any specifications on drawings.

1.3 SUBMITTALS - ATTACHING TO EXISTING WORK

1.3.1 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.

1.3.2 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 TOLERANCES

1.4.1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

1.4.2 Do not permit tolerances to accumulate beyond effective or practical limits.

1.4.3 Comply with manufacturer’s tolerances. In case of conflict between manufacturer's tolerances and Contract Documents, request clarification from Consultant before proceeding.

1.4.4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability before permanently securing Products in place.

1.5 **LOCATION OF EQUIPMENT FIXTURES**

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

1.5.2 Inform Consultant of conflicting installation. Install as directed.

1.5.3 Equipment and fixtures shall be relocated as directed by Consultant by up to 3m complete with all piping, conduit, wiring and accessories required prior installation of the equipment and fixtures at no additional cost to the Contract.

1.6 **QUALITY OF WORK**

1.6.1 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.

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

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

1.7 **PROTECTION OF WORK IN PROGRESS**

1.7.1 Prevent overloading of any infrastructure provided under or affected by this Project.

1.7.2 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

2 **PRODUCTS**

Nil

3 **EXECUTION**

3.1 **EXECUTION**

3.1.1 Execute cutting, fitting, and patching to complete the Work.

3.1.2 Perform all required excavation and fill to complete the Work.

3.1.3 Fit several parts together, to integrate with other Work.

3.1.4 Uncover Work to install ill-timed Work.

3.1.5 Remove and replace defective or non-conforming Work.

3.1.6 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.

3.1.7 Provide openings in non-structural elements of Work for penetrations of mechanical, Work. Limit opening dimensions to minimal sizes required, and performed in a neat and clean fashion.

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

3.1.9 Employ competent workers, or where applicable, original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

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

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

3.1.12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

3.1.13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, for full thickness of the constructed element.

3.1.14 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.

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

3.2 EXISTING UTILITIES AND SERVICES

3.2.1 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 building occupants.

3.2.2 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.

3.3 CO-ORDINATION

3.3.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

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

3.4 CONCEALMENT

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

3.4.2 Before installation, and with timely notice, inform Consultant if there is interference. Install as directed by Consultant.

3.5 REMEDIAL WORK

3.5.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

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

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Requirements and limitations for cutting and patching of Work.

1.2 RELATED SECTIONS

1.2.1 Section 01 11 00 - Summary of Work.

1.2.2 Section 01 61 00 - Product Requirements.

1.2.3 Section 01 62 00 - Product Exchange Procedures: Product options and substitutions.

1.2.4 Individual Product Specification Sections:

.1 Cutting and patching incidental to work of the section.

.2 Advance notification to other sections of openings required in Work of those sections.

.3 Limitations on cutting structural members.

1.3 SUBMITTALS

1.3.1 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 element.

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

.4 Visual qualities of sight exposed elements.

.5 Work of Owner or separate contractor.

1.3.2 Include in request:

.1 Location and description of affected Work.

.2 Necessity for cutting or alteration.

.3 Description of proposed Work and Products to be used.

.4 Alternatives to cutting and patching.

.5 Effect on work of Owner or separate contractor.

.6 Written permission of affected separate contractor.

.7 Date and time work will be executed.

2 PRODUCTS

2.1 MATERIALS

2.1.1 Primary Products: Those required for original installation.

2.1.2 Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 62 00.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

3.1.2 After uncovering existing Work, assess conditions affecting performance of work.

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

3.2 PREPARATION

3.2.1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

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

3.3 CUTTING

3.3.1 Execute cutting and fitting to complete the Work.

3.3.2 Uncover work to install improperly sequenced work.

3.3.3 Remove and replace defective or non-conforming work.

3.3.4 Remove samples of installed work for testing when requested.

3.3.5 Provide openings in the Work for penetration of mechanical and electrical work.

3.3.6 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.4 PATCHING

3.4.1 Execute patching to complement adjacent Work.

3.4.2 Fit Products together to integrate with other Work.

3.4.3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

3.4.4 Restore work with new Products in accordance with requirements of Contract Documents.

3.4.5 Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

3.4.6 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

3.4.7 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Progressive cleaning.

1.1.2 Cleaning prior to acceptance.

1.2 RELATED SECTIONS

1.2.1 This section describes requirements applicable to all Sections and including any specifications on drawings

2 PRODUCTS

2.1 CLEANING MATERIALS

2.1.1 Cleaning Agents and Materials: Low VOC content.

3 EXECUTION

3.1 SOLID WASTE REDUCTION

3.1.1 The Code of Practice contained in the standard construction document CCA81, "A Best Practices Guide to Solid Waste Reduction" are to be followed.

3.2 PROGRESSIVE CLEANING

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

3.2.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

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

3.2.4 Containers:

.1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.

.2 Provide and use clearly marked, separate bins for recycling.

3.2.5 Remove waste material and debris from site and deposit in waste container at end of each working day.

3.2.6 Dispose of waste materials and debris.

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

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

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

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

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

3.3 CLEANING PRIOR TO ACCEPTANCE

3.3.1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

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

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

3.3.4 Remove waste products and debris other than that caused by Owner or other Contractors.

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

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

3.3.7 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.

3.3.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors and other exposed surfaces.

3.3.9 Vacuum clean and dust building interiors, ceilings, wall, floors, behind grilles, louvres and screens.

3.3.10 Clean and polish surface finishes, as recommended by manufacturer.

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

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

3.3.13 Remove dirt and other disfiguration from exterior surfaces.

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

3.4 FINAL PRODUCT CLEANING

3.4.1 Execute final cleaning prior to final project assessment.

3.4.2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

3.4.3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

3.4.4 Remove waste and surplus materials, rubbish, and construction facilities from the site.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Inspections and declarations.

1.1.2 Closeout submittals

1.1.3 Operation and maintenance manual format.

1.1.4 Contents each volume.

1.1.5 As-built actual site conditions.

1.1.6 As-built documents and samples.

1.1.7 As-built documents.

1.1.8 Final survey.

1.1.9 Warranties and bonds.

1.2 RELATED SECTIONS

1.2.1 Section 01 33 00 - Submittal Procedures.

1.2.2 Section 01 45 00 - Quality Control.

1.2.3 This section describes requirements applicable to all Sections of the Specifications.

1.3 INSPECTIONS AND DECLARATIONS

1.3.1 Document 100 - OAA/OGCA Take-Over Procedures shall form the basis of Closeout Procedures for this Project unless otherwise amended by Division 01 Sections.

1.3.2 Contractor's Inspection: Contractor and all Subcontractors shall conduct an 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 that corrections have been made.

.2 Request Consultant's Inspection.

1.3.3 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.

1.3.4 Completion: submit written certificate that following have been performed:

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

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and are fully operational.

.4 Certificates required by authorities having jurisdiction have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for Final Inspection.

1.3.5 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Consultant and Contractor. If Work is deemed incomplete by Owner, complete outstanding items and request re-inspection.

1.3.6 Declaration of Substantial Performance: when Owner consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.

1.3.7 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.

1.3.8 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

1.3.9 Final Payment: When Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

1.3.10 Payment of Hold-back: After issue of Certificate of Substantial Performance of the Work and advertisement of the Certificate of Substantial Performance of the Work in a publication regularly publishing Certificates of Substantial Performance of the Work visible in the locality in which the work was performed, submit an application for payment of hold-back amount. The accrued holdback shall be eligible for certification of payment sixty (60) days after the advertisement of the Certificate of Substantial Performance of the Work provided there are no liens on the property.

1.4 CLOSEOUT SUBMITTALS

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

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

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

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

1.4.5 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.

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

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

1.4.8 Pay costs of transportation.

1.5 OPERATION AND MAINTENANCE MANUAL FORMAT

1.5.1 Organize data in the form of an instructional manual.

1.5.2 Provide the documents in medium or media acceptable to the Owner: hard copy, USB or downloaded digital copy.

1.5.3 Hard Copy requirements:

.1 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm8.5 x 11 inch with spine and face pockets.

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

.3 Cover: Identify each binder with type or printed title 'Project As-built Documents'; list title of project and identify subject matter of contents.

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

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

.6 Text: Manufacturer's printed data, or typewritten data.

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

1.5.4 Provide 1:1 scaled CAD files in AutoCAD format on USB memory stick or digital download as requested by Owner.

1.6 **CONTENTS - EACH VOLUME**

1.6.1 Table of Contents: provide title of project;

.1 date of submission;

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

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

1.6.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

1.6.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

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

1.6.5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate.

1.6.6 Testing and commissioning reports.

1.6.7 Installation, operating instructions and maintenance manuals for each system and piece of equipment provided under the Contract.

1.7 PROVISION OF DOCUMENTS SHOWING ACTUAL SITE CONDITIONS

1.7.1 As-built Drawings: Record information on a set of black line opaque prints of the Contract Drawings issued by the Consultant. Keep the mark-ups for inclusion in the Project Manual.

1.7.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording information changed on site reflecting the actual installation of the Work.

1.7.3 Record information concurrently with construction progress. Do not conceal Work until as-built conditions are accurately recorded on the as-built drawing mark-ups.

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

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

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

.3 Field changes of dimension and detail.

.4 Changes made by change orders.

.5 Details not on original Contract Drawings.

.6 References to related shop drawings and modifications.

1.7.5 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.

1.7.6 Other Documents: maintain manufacturer's certifications, required by individual specifications sections.

1.8 AS-BUILT DOCUMENTS AND SAMPLES

1.8.1 In addition to requirements in General Conditions, maintain at the site for Consultant and Owner one working copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Site Instructions, Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

1.8.2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

1.8.3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

1.8.4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.

1.8.5 Keep as-built documents and samples available for inspection by Consultant.

1.8.6 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of drawing and specification files provided by the Consultant, as follows:

.1 Drawings: AutoCAD and PDF.

.2 Specifications: PDF - Adobe Acrobat.

1.8.7 Employ a competent computer draftsperson to indicate changes on the electronic set of as-built drawings. Provide updated as-built drawings in PDF - Adobe Acrobat along with original hand-marked set.

1.8.8 Submit completed as-built documents to Owner with folder directories for each binder tab on a USB memory stick accompanied by three (3) hard copy sets.

1.9 **WARRANTIES AND BONDS**

1.9.1 Provide signed warranty for Contract indicating guarantee of all products and services provided under the Contract for duration of one (1) year from the date of Substantial Performance of the Contract.

1.9.2 Where warranties are offered by sub-contractors, suppliers or manufacturers, separate each warranty or bond with index tab sheets keyed to Table of Contents listing. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.9.3 Obtain any warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

1.9.4 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.

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

1.9.6 Co-execute submittals when required.

1.9.7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Equipment and systems.

1.1.2 Materials and finishes.

1.1.3 Spare parts.

1.1.4 Maintenance manuals.

1.1.5 Special tools.

1.1.6 Storage, handling and protection.

1.2 RELATED SECTIONS

1.2.1 Section 01 45 00 - Quality Control.

1.2.2 This section describes requirements applicable to all Sections and including any specifications on drawings.

1.3 EQUIPMENT AND SYSTEMS

1.3.1 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.

1.3.2 Provide final set of shop drawings for each piece of equipment complete with Consultant’s review comment sheet and review stamps.

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

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

1.3.5 Provide servicing schedule.

1.3.6 Include manufacturer's printed operation and maintenance instructions.

1.3.7 Include sequence of operation by controls manufacturer.

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

1.3.9 Provide Contractor's coordination drawings, with installed colour-coded diagrams.

1.3.10 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

1.3.11 Additional requirements: As specified in individual specification sections.

2 PRODUCTS

2.1 MATERIALS AND FINISHES

2.1.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

2.1.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

2.1.3 Additional Requirements: as specified in individual specifications sections.

2.2 SPARE PARTS AND MATERIALS

2.2.1 Provide spare parts or materials, in quantities specified in individual specification sections.

2.2.2 Provide items of same manufacturer and quality as items in Work.

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

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

2.3 MAINTENANCE MATERIALS

2.3.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

2.3.2 Provide items of same manufacturer and quality as items in Work.

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

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

2.4 SPECIAL TOOLS

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

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

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

3 EXECUTION

3.1 DELIVER TO SITE

3.1.1 Deliver to site; place and store.

3.1.2 Deliver to location as directed, with inventory list; place and store.

3.2 STORAGE, HANDLING AND PROTECTION

3.2.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

3.2.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

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

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

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

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.

1.2 RELATED SECTIONS

1.2.1 This section describes requirements applicable to all Sections and including any specifications on drawings.

1.3 DESCRIPTION

1.3.1 Demonstrate scheduled operation and maintenance of equipment to Owner's personnel two weeks prior to date of final inspection.

1.3.2 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

1.4.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

1.4.2 Instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

1.5.1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Consultant's approval.

1.5.2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

1.5.3 Give time and date of each demonstration, with list of persons present.

1.6 CONDITIONS FOR DEMONSTRATIONS

1.6.1 Testing and adjusting and equipment and systems are fully operational.

1.6.2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

2 PRODUCTS

Not used.

3 EXECUTION

3.1 PREPARATION

3.1.1 Verify that suitable conditions for demonstration and instructions are available.

3.1.2 Verify that designated personnel are present.

3.1.3 Prepare agendas and outlines.

3.1.4 Explain component design, operational philosophy and operational strategy.

3.1.5 Develop equipment presentations.

3.1.6 Present system demonstrations.

3.1.7 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 **PREPARATION OF AGENDAS AND OUTLINES**

3.2.1 Prepare agendas and outlines including the following: Equipment and systems to be included in seminar presentations.

3.2.2 Name of companies and representatives presenting at seminars.

3.2.3 Outline of each seminar's content.

3.2.4 Time and date allocated to each system and item of equipment.

3.2.5 Provide separate agenda for each system

3.3 **EXPLANATION OF DESIGN STRATEGY**

3.3.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.

.2 Description of design parameters, constraints and operational requirements.

.3 Description of system operation strategies.

.4 Information to help in identifying and troubleshooting system problems.

3.4 **DEMONSTRATION AND INSTRUCTIONS**

3.4.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.

3.4.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

3.4.3 Instruct personnel on control and maintenance of Sensory Equipment associated with maintaining energy efficiency and longevity of service.

3.4.4 Review contents of manual in detail to explain all aspects of operation and maintenance.

3.4.5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during demonstrations to Owner’s personnel.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 20, Division 23 and Division 26.

1.2 REFERENCES

1.2.1 CSA International

.1 CSA S350, Code of Practice for Safety in Demolition of Structures.

.2 National Building Code of Canada (NBC), Part 8 - Safety Measures at Construction and Demolition Sites (2005) and local authority having jurisdiction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3.2 Submit demolition method:

.1 Submit for review and approval by Consultant describing proposed method.

1.4 SITE CONDITIONS

1.4.1 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Consultant immediately.

1.4.2 Proceed only after receipt of written instructions have been received from Consultant.

1.4.3 Notify Consultant before disrupting building access or services.

2 PRODUCTS

Not used.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Inspect building and site with Consultant and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

3.1.2 Locate and protect existing utilities and services. Preserve active utilities and services traversing site in operating condition.

3.1.3 Notify and obtain approval of Owners of utilities or services before starting demolition.

3.1.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

3.1.5 Immediately notify Consultant and Owner of utility or service concerned in case of damage to any utility or service, designated to remain in place.

3.1.6 Immediately notify the Consultant should uncharted utility or service be encountered, and await instruction in writing regarding remedial action. Remediation shall be completed by the Contractor at no cost to the Contract or Owner.

3.2 **PREPARATION**

3.2.1 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, landscaping features and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do Work in accordance with Section 01 35 29 – Health and Safety Requirements.

3.2.2 Demolition/Removal:

.1 Remove items as indicated.

.2 Dispose of all materials off site at facilities accredited for the disposal removed material. Provide all transportation and delivery to the facilities required.

3.2.3 Removal and disposal of Suspended Ceilings:

.1 Remove existing suspended ceilings complete with all framing, grid, hangers, fastenings and associated components. No elements of the existing suspended ceilings shall remain.

3.2.4 Removal of Mechanical and Electrical Services:

.1 Remove and dispose of existing mechanical and electrical services noted for removal complete with accessories, piping, ductwork, conduit and wiring end-to-end back to source of supply and make safe.

.2 Refer to mechanical and electrical drawings and specifications for requirements specific to each trade.

3.3 **CLEANING**

3.3.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

3.3.2 Leave Work area clean at end of each day.

3.3.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.3.4 Refer to demolition drawings and specifications for items to be salvaged for reuse.

3.3.5 There shall be no selling of removed materials at the site. Transport and deliver removed materials for which the Owner has no use to an off-site accredited facility for disposal.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 20, Division 23, Division 26 and Division 28.

1.2 APPLICATION

1.2.1 The Work described in this Section consists of the supply and installation of suspension system and ceiling tiles.

1.3 RELATED SECTIONS

1.3.1 Mechanical Work under Divisions 20 and 23.

1.3.2 Electrical Work under Divisions 26 and 28.

1.4 SAMPLES

1.4.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

1.5 STORAGE AND HANDLING

1.5.1 Protect materials from damage, moisture and soiling during storage, handling and installation.

1.6 SCHEDULING AND CONDITIONS

1.6.1 Coordinate Work with mechanical and electrical subcontractors to ensure clearance for piping, ductwork, conduit, light fixtures and other items indicated on mechanical and electrical Drawings.

2 PRODUCTS

2.1 CEILING TILE

2.1.1 Acoustic ceiling panels: Armstrong Calla Tegular Square Lay-in Smooth Texture 2821, 24" x 48" x 1”. Alternative: CGC Halcyon 97241 or CertainTeed. Colour: white.

2.2 SUSPENSION SYSTEM

2.2.1 Suspension system: Donn DX exposed grid system, or approved similar. Acceptable manufacturers: Bailey Metal Products Limited, Armstrong World Industries Canada Ltd.

2.2.2 Hangers: #9 gauge soft annealed galvanized wire or heavier spaced to accommodate the weight of lighting fixtures, etc. anchored to open-web steel joists (O.W.S.J.'s) or slab above with expansion shields.

2.2.3 Main Tee: double web design with a rectangular bulb, with 25mm (1") exposed flange with a rolled cap, cross tee holes at 150mm (6") o.c. and integral reversible splice.

2.2.4 Cross Tee: double web design with a rectangular bulb with 25mm (1") exposed flange with a rolled cap; web extending to form a positive interlock between cross tee webs with the lower flange extended and offset.

2.2.5 Wall mounting: angle shape with a 19mm (3/4") exposed face. Moulding to be crimped at site with a tool to accept `T' section and intersection.

2.3 ACCESSORIES

2.3.1 Provide t-bar trims for all existing equipment and fixtures that are remaining so that they may be properly mounted into the new t-bar ceiling. The existing equipment and fixtures include but are not limited to the jiffy poles, fire alarm detection devices, furniture posts, supply air diffusers, return air grilles, egress signage emergency lighting, free air communications cable entries, security motion sensors and closed-circuit television (CCTV) cameras.

2.3.2 Investigate the locations of the existing fixtures and equipment remaining at the site prior shop drawing submission to provide the trims suitable for mounting the existing fixtures and equipment to the new t-bar ceilings. Co-ordinate with the existing equipment suppliers where known and the t-bar ceiling supplier.

2.3.3 Co-ordinate accessories required to mount the new lighting fixtures in the t-bar ceiling with the lighting fixture suppliers.

2.3.4 Provide t-bar spacer brackets for the existing fire alarm system devices, emergency lighting, egress signage, CCTV cameras, security devices and similar devices so they supported by the hanger grid independently of the acoustical tiles in which they are mounted.

2.3.5 T-bar trims shall be selected to match the ceiling and t-bar grid colours.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Carry out Work by mechanics skilled in this trade and in strict accordance with the system manufacturer's printed instructions to produce a first-class, flush-finished surface in true plane, free from drooping and warping.

3.1.2 Lay out work according to reflected ceiling plan and so that borders are uniform and joints are straight.

3.1.3 Erect main Tees at required elevation and level to vertical tolerance of 3mm in 3.5m. Hangers to be at maximum of 900mm (3'0") centres both ways; not more than 150mm (6") from ends and where normally required in good standing practice. Suspended ceiling including light fixtures, etc. shall not deflect more than 1/360 span.

3.1.4 Suspend ceilings from joists above with hangers, independent of walls, columns, ducts or pipes.

3.1.5 Follow specified construction for fire-rated ceilings.

3.1.6 Suspend light fixtures independently of the suspended ceiling. Provide chains from fixtures to ceiling slab when available.

3.1.7 Do not support hangers directly to roof deck to minimize damage to roof membrane. Provide uni-strut channels from which to support the ceiling hangers and lighting fixtures at ceilings below roof deck on second floor of building.

3.1.8 Do not use ramset guns to suspend hangers for ceiling.

3.1.9 Supply and install hold down clips in fire-rated ceilings.

3.1.10 Install acoustical panels in ceiling grid in locations as indicated on drawings.

3.1.11 Install support brackets for egress signage, emergency lighting, CCTV cameras and similar devices across grid channels. Provide t-bar trim pieces around penetrations in the t-bar tiles for cables and conduits serving the devices.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Materials and methods for mechanical work.

1.2 RELATED SECTIONS

1.2.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02, Division 09, Division 23 and Division 26.

1.3 INTENT

1.3.1 Provide complete and fully operational mechanical systems with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.

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

1.3.3 The Work is suitably outlined on the Drawings with regard to sizes, locations, general arrangements and installation details, and has been generally coordinated for routing of services. The routing of ductwork, piping and equipment arrangement are shown more or less in diagrammatic form except where in certain cases the Drawings may include details giving the exact locations and arrangements required. Contractor shall allow in base price for relocation of any and all existing services as necessary in order to install new equipment, ductwork, piping, conduit, etc and to make room for any new penetrations.

1.3.4 The location of equipment, and the associated arrangement of piping, ductwork, and other material describes the general requirements of the Work. Final location is dependant on the actual equipment supplied. The Consultant reserves the right to make reasonable adjustment of up to 3 meters to the location of equipment, floor drains, routing of major piping and ductwork, at no additional cost to the Owner.

1.3.5 In order to provide clarity to the arrangement of the Work, not all details including valves, thermometers, pressure gauges, etc. are shown on the plan Drawings. Refer to schematic Drawings, standard details and the specification for these requirements. In the absence of specific details, the Contractor is expected to follow generally accepted good installation practices. Alternatively, Contractor shall submit a written request for information (RFI) to the Consultant and obtain a ruling prior to proceeding with the Work.

1.3.6 Where Standard Details are provided, these show the general installation requirements, and are applicable to each occurrence in the Work, unless otherwise specified or shown.

1.3.7 Coordinate Work with all trades to ensure a proper and complete installation. Notify all trades concerned of the requirements for openings, sleeves, inserts and other hardware necessary for the installation and , where Work is to be integrated with the Work of other trades or is to be installed in close proximity with the Work of the trades, carefully coordinate the Work prior to installation.

1.3.8 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work in advance so as to avoid interferences.

1.3.9 Connect to equipment furnished in other sections and by Owner, including uncrating equipment, installing, starting, and testing.

1.3.10 Any obvious ambiguities in the project documents shall be brought to the Consultant's attention at the time of tendering. Claims for extra monies will not be entertained if ambiguities in the tender documentation are not highlighted prior to tender closing.

1.4 CUTTING AND PATCHING - EXECUTION

1.4.1 Locate holes and provide sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

1.4.2 Perform patching in finished construction of building under the sections of specifications covering these materials.

1.5 SHOP DRAWINGS AND PRODUCT DATA

1.5.1 Submit detailed shop drawings and product data complete with performance data, electrical data and physical data of all equipment and accessories.

1.5.2 Indicate manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Indicate sizes, types, model numbers, ratings, capacities and options actually being proposed.

1.5.3 Include dimensional data for roughing in and installation, and technical data sufficient to confirm that equipment meets requirements of drawings and specifications.

1.5.4 Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.

1.6 SUBMITTALS FOR INFORMATION

1.6.1 The following submittals are for information only; do not request these submittals if the information submitted will be assessed for acceptability.

1.6.2 Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

1.7.1 The following submittals are for project close-out purposes; do not request these submittals if the information submitted will be assessed for acceptability.

1.7.2 Accurately record actual locations of equipment, accessories, structural reinforcement repairs, type of repair, and electrical details of all connected equipment.

1.8 OPERATING AND MAINTENANCE MANUALS

1.8.1 Provide digital copies copies of O&M manuals.

1.8.2 Include in the O&M manuals all documentations as noted in Specifications Section 01 78 10.

1.9 AS-BUILT DRAWINGS

1.9.1 Keep on site, an extra set of drawings and specifications recording changes and deviations daily.

1.9.2 Include for the work required to transfer site changes to Consultant's original CAD files and providing the Owner with one set of hard copy and electronic files of all identified 'As-Built Drawings'.

1.10 **ACCEPTABLE MATERIALS AND EQUIPMENT**

1.10.1 Include for products that meet the requirements of the specifications and the design intent and that are manufactured by reputable manufacturers with a proven track record of at least 5 years.

1.11 **EQUIPMENT PROTECTION AND CLEAN-UP**

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

1.11.2 Protect equipment with polyethylene covers and crates.

1.11.3 Operate, drain and flush bearings and refill with change of lubricant before final acceptance.

1.11.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Provide extended nipples for lubrication.

1.11.5 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.

1.12 **MATERIAL AND EQUIPMENT**

1.12.1 Material and Equipment: New and quality specified. Statically and dynamically balanced rotating equipment for minimum vibration and low operating noise level.

1.12.2 Include for all concrete work for mechanical installations. Provide engineered structural drawings and dimensional drawings, templates, anchor bolts and accessories required for mounting and anchoring equipment.

1.13 **MATERIAL IDENTIFICATION**

1.13.1 Identify piping, and equipment throughout with labels and direction of flow arrows. Apply labels at 1.5 metre intervals, before and after pipes pass through walls, at access door openings or closer.

1.13.2 Provide 20 mm diameter brass number tags with number stamped in black, secured to valve wheel with key chain for valves not in plain sight of apparatus controlled. Provide neat, typewritten directories giving valve number, valve service and location of valves. Frame one copy under glass for wall mounting.

1.13.3 Identify electric starting switches and remote push-button stations with 6 mm laminated plastic plates.

1.14 **FLASHING**

1.14.1 Flash , counter flash, roof /wall insulation and water proofing where mechanical systems passes through weather or waterproofed walls, floors and roofs.

1.15 **INSERTS**

1.15.1 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

1.15.2 Size inserts to suit threaded hanger rods.

1.16 **ACCESS DOORS**

1.16.1 Access doors to match surrounding surface, provided with recess to accept matching finish. Provide ULC rated doors in fire rated construction.

1.16.2 Provide flush type steel framed panel with concealed hinges, size minimum 300 mm x 300 mm for inspection and hand access, and minimum 600 mm x 600 mm for man access.

1.16.3 Provide cam type locking device with hand or key lock when located in public corridors and washrooms complete with master keys.

1.16.4 Provide access doors for maintenance or adjustments purposes for all mechanical system components including valves, volume and splitter dampers, fire dampers, clean outs and traps, controls, coils and terminal units, and expansion joints.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02, Division 09, Division 23, Division 26 and Division 28.

1.1.2 Refer to other divisions of the Specifications and to the Drawings for work related to the mechanical work to avoid interferences with work of other trades (and other contractors) and to ensure proper completion of the work as a whole.

1.2 GENERAL CONSTRUCTION REQUIREMENTS

1.2.1 Applicable Codes and Standards

.1 Ontario Building Code

.2 Occupational Health and Safety Act and Regulations for Construction Projects, Ontario Regulation 691.

.3 Owners Health and Safety Requirements

1.2.2 Measurements and Deviations

.1 Where any parts of the mechanical work are specifically located by dimensions on the Drawings, check and verify these dimensions on site prior to installation.

.2 Before installing piping, review architectural, structural and electrical Drawings with mechanical Drawings
   .1 Where interference may occur and departures from arrangements as shown are required, consult with other trades involved, come to agreement as to changed locations or elevations and obtain approval of the Consultant for proposed changes before proceeding with the work.

.3 Examine work of other trades or contractors, prior to commencement of mechanical installations.
   .1 Report in writing, to the Consultant, any discrepancies which will affect mechanical installations.
   .2 Failure to do so shall be considered acceptance of the conditions.

.4 Where site conditions require minor deviations from indicated arrangements or locations, make such changes on approval of the Consultant without additional cost to the Owner.

.5 Should any discrepancies occur during installation of mechanical work which will necessitate major revisions to the mechanical trades work or the work of other trades or contractors, notify the Consultant immediately and obtain written authorization before proceeding with the work.
Building Attachments:

.6 Obtain prior written Consultant’s approval before drilling, cutting or welding of the building steel or building structure for erection of materials or equipment.

1.2.3 Overloading

.1 During installation of mechanical work, do not load any part of the building structure with a load greater than it is capable of bearing.
  .1 Should any accident occur or damage result through the violation of this requirement, the contractor shall be held solely responsible.

.2 Design temporary supports used during installation as being equivalent to permanent supports.

.3 Remove temporary supports at completion of work.

1.2.4 Cutting and Patching

.1 Do not cut, remove or burn structural parts or sections of the building, whether they are steel, concrete or masonry without the written authorization of the Consultant.

.2 Should cutting, repairing, and patching of previously finished work of other trades be required to allow installation of mechanical work, pay all costs for the trade concerned to perform the work.

2 PRODUCTS

2.1 BUILDING ATTACHMENTS

2.1.1 Flexible Connectors

.1 Stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings and product sheets must be provided to the Consultant for approval.

.2 Acceptable Manufacturers:
  .1 Hyspan Precision Products Inc;
  .2 Senior Flexonics Ltd;
  .3 The MetraFlex Co;
  .4 Or Approved Equal.

2.1.2 Welding Studs

.1 Maximum size: 10mm (3/8") for attaching miscellaneous materials and equipment to building steel.

.2 If the weight of materials or equipment require bolts or studs larger than 10mm (3/8") diameter, use steel clips or brackets, secured to building steel by (welding or) bolting as approved by the Consultant.

.3 Acceptable Manufacturers:
  .1 Graham
  .2 Omark
  .3 Nelson
  .4 Or approved equivalent

2.1.3 Supports for any suspended items:

.1 Do not fasten/attach to or extend through steel pan type roofs or through concrete slab roofs.

2.1.4 Truss or steel joist roof or floor framing:

.1 Locate hangers at or within 150mm (6") of the joist top or bottom chord panel points

.2 Otherwise provide additional structural steel as required where hanger spacing does not coincide with joist spacing.

.3 Transmit hanger load only concentrically to the supporting truss or joist.

2.1.5 Secondary structural steel members between trusses and/or joists:

.1 Locate at or within 150mm (6") of top or bottom chord panel points.

.2 Where the secondary structural steel member cannot be located at or near a truss or joist panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member.
.1 The above condition may be waived if the load to be suspended between panel points is not in excess of 45kg (100 LB).

.3 Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted.

2.2 SEALANTS

2.2.1 Caulking Compounds

.1 Acceptable Manufacturers:
.1 Denso-Plast
.2 Or approved equivalent

2.2.2 Firestopping

.1 ULC listed firestopping assembly

.2 Rating to suit wall and floor penetrations

.3 Acceptable Manufacturers:
.1 Hilti
.2 Fire Stop Systems
.3 Dow Corning
.4 3M
.5 Tremco
.6 A/D Fire Protection System
.7 Johns Manville
.8 Or approved equivalent

2.3 **MISCELLANEOUS**

2.3.1 Access Doors

.1 Size:
- .1 Minimum size: 300mm x 300mm (12" x 12") size, unless otherwise specified on the Drawings or in other divisions of the Specifications, or as required to replace or repair said equipment.
- .2 Provide 600 x 600 size access doors where personnel entry is required.
- .3 Where access doors are required to be located in fire rated walls, floors and ceilings, provide ULC listed and labelled units having a minimum rating in hours per NBC for the structure being penetrated.

.2 Material:
- .1 Fabricated of 2.5mm (12 ga) bonderized steel.
- .2 Fabricated of 2.5mm (12 ga) stainless steel in areas finished with tile or marble surfaces.
- .3 Flush mounted, concealed hinges and screwdriver lock.
- .4 Plast lock and anchor straps.
- .5 Doors to be of a type and fire rating to suit the particular type of wall or ceiling construction in which they are to be installed.

.3 Acceptable Manufacturers:
- .1 E.H. Price
- .2 Titus
- .3 Controlled Air
- .4 Williams (S.M.S.)
- .5 Acudor
- .6 Or approved equivalent

2.3.2 Fabricated Equipment Supports (Floor Stands and Ceiling or Wall Mounted Supports)

.1 Structural steel members of welded construction or steel pipe and fittings, suitably braced and secured to the floor by mild steel floor pads or pipe flanges with bolts or anchors.

3 **EXECUTION**

3.1 **EQUIPMENT**

3.1.1 General

.1 Install equipment in a compact, neat and workmanlike manner.
- .1 Align, level and adjust for satisfactory operation.
- .2 Install in such a manner that connecting and disconnecting of piping and accessories can be made readily and that all parts are easily accessible for inspection, operation, maintenance and repair.

.2 Install and start up items of equipment in accordance with the manufacturer's printed installation and operating instructions.

3.1.2 Noise and Vibration

.1 Noise and vibration levels of equipment and systems shall be within design intent.

.2 If noise or vibration levels created by any mechanical equipment and systems and transmitted to occupied portions of building or other mechanical work are over the limits, make all necessary changes and additions as approved by the Consultant without additional cost.

3.2 MISCELLANEOUS STEEL

3.2.1 General

.1 Hang or support equipment, piping, ductwork etc., with miscellaneous structural supports, platforms, braces as may be required unless Drawings or other Sections of the Specifications state otherwise.

3.2.2 Materials and Fabrication

.1 Conform to:
- .1 CAN/CSA-S16.1-M for materials, design of details and execution of the work.
- .2 CSA-G40.20/G40.21 grade 300W for structural shapes, plates, etc.
- .3 CSA W47.1 - for qualification of welders.
- .4 CSA W48.1-M - for electrodes (only coated rods allowed).
- .5 CSA W59-M - for design of connections and workmanship.
- .6 CSA W117.2 - for safety.

.2 Construction:
- .1 Welded construction wherever practicable.
- .2 Chip welds to remove slag, and grind smooth.
- .3 Bolted joints allowed for field assembly using high strength steel bolts.

3.2.3 Painting and Cleaning

.1 Clean steel to Steel Structures Painting Council SSPC-SP6, Commercial Blast Cleaning.

.2 Apply one coat of oil alkyd primer conforming to CISC/CPMA 2.75 to all miscellaneous steel.

.3 In the field, touch up all bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as hereinbefore specified.

.4 Apply two coats of primer to all surfaces which will be inaccessible after erection.

.5 Thoroughly remove all foreign matter from steelwork on completion of installation.

3.3 CONCRETE INSERTS

3.3.1 General

.1 Install inserts required for attachment of hangers, either for suspension of piping or equipment.

.2 For masonry or poured concrete construction use expansion type units. Insert into the concrete after concrete has cured. Do not use anchors or inserts installed by explosive means.

3.4 FIRE STOPPING

3.4.1 Submittals

.1 Submit shop Drawings, including the following information:
- .1 ULC/CUL listing number
- .2 Installation Drawings for each type of penetration
- .3 Installation materials

3.4.2 General

.1 Seal piping, ductwork, conduits and miscellaneous support steel penetrating fire separations.

.2 Install fire stopping in accordance with manufacturer's instructions and ULC listing requirements.

.3 Provide a written report on completion of fire stopping, by area or floor if necessary, indicating the work is completed and ready for inspection. Do not cover over fire stopping, including installation of walls and ceilings, until work is inspected.

3.5 ACCESS DOORS

3.5.1 General

.1 Supply access doors for installation by other trades in walls or ceilings where accessibility is required for the operation and/or maintenance of:
- .1 Concealed valves
- .2 Traps
- .3 Cleanouts
- .4 Dampers
- .5 Fan Coil Units
- .6 Controls equipment

3.6 ADJUSTMENT AND OPERATION OF SYSTEMS

3.6.1 General

.1 When the work is complete:
- .1 Adjust equipment items of the various systems for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.
- .2 Complete additional instructions are specified under the respective Sections of Division 15.

.2 The Consultant reserves the right to require the services of an authorized representative of the manufacturer in the event that any item of equipment is not adjusted properly.
- .1 Arrange for such services and pay all costs thereof.
- .2 After completion of adjustments, place systems in full operating condition and advise the Consultant that the work is ready for acceptance.

3.7 **ACCEPTANCE**

.1 General

.1 After all equipment has been installed and adjusted and all systems balanced:

.1 Conduct performance tests in the presence of the Consultant and the Owner.

.2 Arrange the time for these tests at the convenience of the Consultant and the Owner.

.3 Conduct tests under climatic circumstances to ensure complete and comprehensive tests and of such a manner and duration as the Consultant may deem necessary.

.2 During these tests:

.1 Demonstrate the correct performance of all equipment items and of the systems they comprise.

.2 Should any system or any equipment item fail to function as required, make such changes, adjustments or replacements necessary to meet performance requirements.

.3 Repeat tests until requirements have been fully satisfied and all systems accepted by the Consultant.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02, Division 09, Division 23, Division 26 and Division 28.

1.1.2 Refer to other divisions of the Specifications and to the Drawings for work related to the mechanical work to avoid interferences with work of other trades (and other contractors) and to ensure proper completion of the work as a whole.

1.2 REFERENCES

1.2.1 ASHRAE Standard 55, Thermal Environmental Conditions for Human Occupancy.

1.2.2 ASHRAE Standard 70, Method of Testing the Performance of Air Outlets and Inlets.

1.2.3 CSA, Canadian Standards Association.

1.2.4 OBC, Ontario Building Code.

1.2.5 ULC, Underwriter's Laboratory of Canada.

1.3 SUBMITTALS

1.3.1 Submit in accordance with Section 01 33 00.

2 PRODUCTS

2.1 GENERAL

2.1.1 Products shall meet size, capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated in manufacturer's Product data for the design performance criteria specified.

2.1.2 Frames:

.1 Full perimeter gaskets.

.2 To suit mounting application and in accordance with Contract Drawings.

.3 Oversized grilles, registers and diffusers to be suitably reinforced and provided with mullions to provide rigidity without compromising performance or operation.

2.1.3 Finish:

.1 Aluminum Products:
- .1 Brushed finish with clear coat epoxy.
- .2 Powder coat paint finish, 50-75 micron (2.0 – 3.0 mils).
- .3 Refer to Drawing schedule for finish application.

.2 Stainless steel Products: #4 finish for borders, #2B for blades.

.3 Durable, corrosion and wear resistant.

2.1.4 Colour as specified or as shown on Contract Drawings.

2.1.5 Manufacturers
- .1 E.H. Price

.2 Nailor Industries Inc.
.3 Titus
.4 Tuttle & Bailey
.5 Carnes® Company
.6 Krueger-HVAC
.7 Or approved equivalent

2.2 RETURN AND EXHAUST GRILLES

2.2.1 Grilles shall be egg crate grilles as scheduled on Contract Drawings.

.1 High capacity, high free area, low sound and pressure drops.

.2 13 x 13 x 13 mm aluminum grid core.

.3 Extruded aluminum construction.

.4 8 mm channel frame for non-ducted lay-in ceiling application.

2.3 DIFFUSERS

2.3.1 Diffusers shall be square cone, adjustable diffuser as scheduled on Contract Drawings.

.1 Four cones, single piece die formed cones, aluminum construction.

.2 360° angle radial air pattern, adjustable from full horizontal to full vertical from face operated tabs.

.3 32 mm border for flat surface mount and border for lay-in ceiling applications.

.4 Neck mounted radial opposed blade damper with concealed operator.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Install grilles and diffusers in accordance with manufacturer's recommendations.

3.1.2 Co-ordinate installation of grilles and diffusers with ceiling installation.

3.1.3 Adjust grille and diffuser installation to satisfaction of Owner.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02, Division 09, Division 26 and Division 28.

1.2 APPLICATION

1.2.1 This Section applies to and is an integral part of all succeeding Sections of this Division of the specification.

1.3 DEFINITIONS

1.3.1 The following are definitions of words found in Sections of this Specification and on associated drawings:

1.3.2 "Concealed" - hidden from normal sight in furred spaces, shafts, crawl spaces, ceiling spaces, walls and partitions;

1.3.3 "Exposed" - all work normally visible to building occupants;

1.3.4 "Provide" (and tenses of "Provide") - supply, install and connect complete.

1.3.5 "Install" (and tenses of "install") - install, and connect complete;

1.3.6 "Supply" - Supply only.

1.3.7 "Work" - all equipment, permits, materials and labour to provide a complete electrical installation as required and detailed in Drawings and Specification.

1.3.8 "Authorities" or "Authorities Having Jurisdiction" - any and all current laws and/or by-laws of any federal, provincial or local authorized agencies having jurisdiction over the sum total or parts of the work including, but not restricted to the Municipal Planning and Building Department, Municipal Fire Department, Labour Canada, The Provincial Fire Marshall, The Local Hydro Supply Authority, The Ontario Building Code, The Construction Safety Act, Municipal Public Works Department, the Canadian Electrical Code with Ontario Supplement, hereinafter referred to as the "Code", the Electrical Safety Authority and all Inspection Bulletins.

1.3.9 "Drawings and Specifications" - "the Contract Drawings and Specifications".

1.3.10 "Consultant" shall mean the firm of Moon Matz Ltd., or other person authorized to act on their behalf.

1.4 WORK INCLUDED

1.4.1 The work shall include all labour, materials, equipment, permits, inspections and tools required for a complete supply and installation of electrical and related installation as shown on the Drawings and as described in Divisions 26 and 28 and related sections of the Specifications.

1.5 SCHEDULING OF PRODUCT DELIVERY

1.5.1 Every effort must be made to ensure delivery of all materials and products in the Tender Documents on time. At commencement of Tender, prepare schedule of order dates for items requiring long delivery periods.

1.6 **EXAMINATION OF SITE**

1.6.1 Prior to submitting a bid carefully examine conditions at the site, which may or will affect the work. Refer to and examine all Tender documents, including room finish schedules to determine finished, partially finished and unfinished areas of the building.

1.6.2 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into the spaces where they are to be located without difficulty. Be responsible for any cutting and patching involved in getting assemblies into place.

1.7 **QUALITY ASSURANCE:**

1.7.1 General Codes and Standards:

.1 Comply with the Ontario Building Code and Canada Labour Code, Part 4.

.2 Where provisions of pertinent codes or local by-laws conflict with these Specifications and Drawings or each other, comply with the more stringent provisions.

.3 Operating voltages shall comply with CAN3-C235-83 (R2015).

.4 Ground system shall comply with CSA Standard C22.1.

.5 Abbreviations for electrical terms: to CSA Z85-1983

1.7.2 Provide new materials bearing certification marks or labels acceptable under Ontario Electrical Safety Code.

.1 Equipment must bear, on manufacturer's label, certification mark or label acceptable under Electrical Safety Authority for the application it is being used.

1.7.3 Provide units of same manufacture where two or more units of same class or type of equipment are required.

1.7.4 Manufacturer's names are stated in this Specification to establish a definite basis for bid submission and to clearly describe the quality of product that is desired for the work.

1.7.5 Standard Specifications

.1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all products provided comply with latest issue of applicable Standard Specifications issued by authorities having jurisdiction, but such Standard Specifications shall not be applied to decrease the quality of workmanship, products and services required by the Tender Documents.

1.7.6 Electrical Codes and Permits:

.1 The work shall be bid on and shall be carried out in accordance with these Drawings and Specifications and shall comply with the essential requirements of the latest editions of the Canadian Electrical Code C. 22.1 and the Electrical Safety Code (together with applicable bulletins issued by the Inspection Department of Electrical Safety Authority). In no instance, however, shall the standards established by the Drawings and Specifications be reduced by any of

the codes referred to above. In the event of conflicting requirements, the codes shall take precedence over these Tender Documents and the Consultant's decision shall be final.

.2 Arrange for and obtain all necessary permits, inspection and approvals from authorities having jurisdiction, and also pay all applicable fees. The Contractor shall conform with all Municipal Codes and By-laws which affect the work.

.3 Applicable Codes
- .1 Ontario Electrical Safety Code and Bulletins issued by the Inspection Department of Electrical Safety Authority
- .2 Canadian Electrical Code with applicable regional amendments
- .3 Ontario Building Code
- .4 CSA C282 (latest edition) Emergency Power Supply for Buildings
- .5 Technical Standards and Safety Authority
- .6 National Building Code
- .7 Ontario Fire Code
- .8 National Fire Code

.4 Before starting any work, submit the required number of copies of Drawings and Specifications to the Electrical Safety Authority and the local authority for approval and comments. Comply with any changes requested as part of the Tender, but notify the Consultant immediately of such changes for proper processing of these requirements. Prepare and furnish any additional Drawings, details or information as may be required by the Consultant.

.5 On or before the completion of this Tender, obtain at own expense, the necessary certificates of inspection and acceptance from the Inspection Branch of the Electrical Safety Authority of Ontario and forward same to the Consultant and Owner.

.6 Equipment and material shall be acceptable to Electrical Safety Authority.

.7 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.

.8 Supply and install warning signs and nameplates as required by the Electrical Safety Authority.

.9 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Tender Drawings and Specifications may be used for this purpose.

1.8 **REQUIREMENTS OF DRAWINGS:**

1.8.1 Tender:

.1 The Drawings for electrical work are essentially performance drawings, partly schematic, intended to convey the scope of work and extent of work. They only indicate general arrangement and approximate location of apparatus, fixtures and general typical sizes and locations of equipment and connections. The Drawings do not intend to show architectural, structural or mechanical details.

.2 Do not scale Drawings, but obtain information involving accurate dimensions to structure from those shown on Architectural and Structural Drawings, or by site

measurements of existing areas. Follow the Electrical Drawings in laying out the work but consult general Construction Drawings as well as detail Drawings to become familiar with all conditions affecting the work, and verify spaces in which the work will be installed and structures to which it will be attached.

.3 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.). Alter, at no additional cost, the location of materials and/or equipment up to 3m, or as directed, provided that the changes are made before installation and do not necessitate additional material or labour.

.4 Leave space clear and install work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by other trades. Verify all equipment sizes in relation to space allowed and check all clearances.

.5 Confirm on the site, the exact location and mounting elevation of equipment and fixtures as related to Architectural or Structural details. Confirm location of outlets and/or connection points for equipment supplied by other trades.

1.9 **SHOP DRAWINGS:**

1.9.1 Pay careful attention to all shop drawings and review comments and ensure that all requirements are fully complied with.

1.9.2 Submit manufacturer's or vendor's drawings for all products being furnished except cable (up to 1000V), wire and conduit for review prior to commencement of work. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assembly. Ensure submissions contain adequate data to easily confirm equipment meets the requirements of these Specifications.

1.9.3 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences. Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.

1.9.4 Submit prior to commencement of work for review, properly identified shop drawings showing in detail the design and construction of all equipment and materials as requested in sections of the specification governed by this Section.

1.9.5 Obtain and comply with the manufacturer's installation instructions.

1.9.6 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS", stamp each copy with contractor company name, date each copy with the submittal date, and sign each copy. Shop drawings which are received and are not endorsed, dated and signed will be returned for re-submittal.

1.9.7 The Consultant will stamp shop drawings as follows:

.1 Drawing: Reviewed ( )

.2 Reviewed as Modified ( )

.3 Revise and Resubmit ( )

.4 Rejected ( )

1.9.8 If "REVIEWED" is checked-off, the shop drawing is satisfactory. If "REVIEWED AS MODIFIED" is checked-off, the shop drawing is satisfactory provided requirements of remarks put on shop drawing copies are met. If "REVISE AND RE-SUBMIT" is checked-off, the shop drawing and equipment selection must be revised in accordance with comments written on shop drawing copies and resubmitted. If "REJECTED" is checked-off, the shop drawing is in error of submission and the equipment described therein shall not be used for this project.

1.9.9 This review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Tender documents. Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co- ordination of the work as well as compliance with codes and inspection authorities such as ESA, CSA., UL, ULC, etc.

1.9.10 Co-ordinate Work of this Division such that items will properly interface with Work of other Divisions.

1.9.11 Architectural Drawings, or in the absence of Architectural Drawings, Mechanical Drawings govern all locations.

1.10 **SUBSTITUTIONS**

1.10.1 When only one manufacturer's catalogued trade name is specified, provide only that catalogued trade name, material or product.

1.10.2 When more than one manufacturer's trade name is specified for a material or product, the choice is the bidder’s.

1.10.3 If an alternate product is desired to be used (for equipment and material other than specified equipment or system), a written RFI (Request For information) shall be submitted for review by the Consultant. Acceptance of alternates will be at the sole discretion of the Owner and Consultant. A response to the RFI will be issued confirming whether or not the alternate system is acceptable.

1.11 **DIMENSIONS AND QUANTITIES**

1.11.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.

1.11.2 Quantities or lengths indicated in Tender Documents are approximate only and shall not be held to gauge or limit the Work.

1.11.3 Make necessary changes or additions to routing of conduit, cables, and the like to accommodate structural, mechanical and architectural conditions. Where raceways are shown diagrammatically run them parallel to building column lines.

1.12 **EQUIPMENT LOCATIONS**

1.12.1 Devices, fixtures and outlets may be relocated, prior to installation, from the location shown on the Tender Drawings, to a maximum distance of 3 m without adjustment to Tender price.

1.12.2 Switch, control device and outlet locations are shown diagrammatically.

1.13 **WORKING DRAWINGS AND DOCUMENTS**

1.13.1 Contractor may be required to prepare working detail drawings supplementary to the Tender drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of materials and or apparatus occur, or where work due to architectural and structural considerations involves special study and treatment. Such drawings may be prepared jointly by all trades affected, or by the one (1) trade most affected with due regard for and approval of the other trades, all as the Consultant will direct in each instance. Such drawings must be reviewed by the Consultant before the affected work is installed.

1.13.2 Carry out all alterations in the arrangement of work which has been installed without proper study and approval, even if in accordance with the Tender documents, in order to make such work come within the finished lines of walls, floors and ceilings, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

1.14 **INSTALLATION DRAWINGS**

1.14.1 Prepare installation drawings for equipment, based upon approved Vendor drawings, to check required Code clearances, raceway, busway and cable entries, sizing of housekeeping pads and structure openings. Submit installation drawings to Consultant for review.

1.15 **"AS BUILT" DRAWINGS**

1.15.1 Maintain a set of Tender Drawings on site and record all deviations from the Tender Documents. As a mandatory requirement, recording must be done on the same day deviation is made. Be responsible for full compliance with this requirement.

1.15.2 Mark locations of feeder conduits, junction and terminal boxes and ducts or conduits run underground either below the building or outside the building.

1.15.3 Where conduit and wiring are underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.

1.15.4 Record deviations from branch circuit numbers shown on Drawings.

1.15.5 Prepare diagrams of interconnecting wiring between items of equipment including equipment supplied by Owner and under other Specification Sections.

1.16 **TEST REPORTS**

1.16.1 For each check and test performed prepare and submit a Test Report, signed by the Test Engineer, and where witnessed, by the Consultant.

1.16.2 Include record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.

1.16.3 Include calibration record, percentage error and applicable correction factors.

1.16.4 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

1.17 **FIRE BARRIERS**

1.17.1 Where electrical material or devices pass through fire rated separations, make penetrations and provide fire barrier seals with a fire resistance rating equivalent to the rating of the separation.

1.17.2 Prior to installation, submit for review, proposed fire barrier seal materials, method of installation and ULC system number.

1.17.3 Acceptable Manufacturers:

.1 A/D Fire Protection Systems

.2 Dow Corning

.3 Fire Stop Systems

.4 IPC Flamesafe Firestop

.5 Nelson Electric

.6 3M

.7 Tremco

.8 Hilti

1.18 **MISCELLANEOUS METAL FABRICATIONS**

1.18.1 Provide miscellaneous structural supports, platforms, braces, brackets and preformed channel struts necessary for suspension, attachment or support of electrical. All supports, platforms, brackets and channel struts shall be made of stainless steel material.

1.19 **SLEEVE AND FORMED OPENING LOCATION DRAWINGS**

1.19.1 Prepare and submit to the Consultant for review and forward to the appropriate Sub-trade drawings indicating all required sleeves. Such drawings shall be completely and accurately dimensioned and shall relate sleeves, recesses, and formed openings to suitable grid lines and elevation datum. Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Tender. Make all modifications to locations as directed by a Structural Engineer at no extra cost to Tender.

1.20 **SUPERINTENDENCE**

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

1.21 **PATENTS**

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

1.22 **RIGHTS RESERVED**

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

1.23 **METALS**

1.23.1 Steel construction required solely for the work of electrical trades and not shown on architectural or structural drawings shall be provided by this trade in accordance with applicable code requirements.

1.24 **FLASHING**

1.24.1 Flash electrical parts passing through or built into a roof, an outside wall, or a waterproof floor.

1.24.2 Provide sleeves passing through outside walls with lead or copper flashing as directed.

1.25 **WORKMANSHIP**

1.25.1 Install equipment, ductwork, conduit and cables in a workmanlike manner to best suit space, to present a neat appearance and to function properly to the satisfaction of the Consultant.

1.25.2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore.

1.25.3 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers installation instruction.

1.25.4 Replace work unsatisfactory to the Consultant without extra cost.

1.25.5 Make provision to accommodate future plant and equipment indicated on drawings.

1.25.6 Protect from damage all equipment delivered to the site and during installation. Any damage or marking of finished surfaces shall be made good to the satisfaction of the Consultant.

1.26 **MOUNTING HEIGHTS**

1.26.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

1.26.2 If mounting height of equipment is not indicated verify before proceeding with installation.

1.27 OWNER RIGHT TO RELOCATE ELECTRICAL ITEMS

1.27.1 The Owner reserves the right to relocate electrical items (light fixtures, battery pack) during construction, but prior to installation, without cost, assuming that the relocation per item does not exceed 3 m (10'-0") from the original location. No credits shall be anticipated where relocation per item of up to and including 3m reduces materials, products and labour.

1.27.2 Should relocations per item exceed 3m from the original location the Tender price will be adjusted accordingly.

1.27.3 Necessary changes, due to lack of co-ordination, and as required and when approved, shall be made at no additional cost, to accommodate structural and building conditions. The location of pipes and other equipment shall be altered without charge to the Owner, if approved, provided the change is made before installation.

1.28 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

1.28.1 Each copy of the manual shall include:

.1 A set of as-built prints;

.2 Letters of Owners Instructions;

.3 Final Electrical Safety Authority Certificates of Inspection and Acceptance;

.4 A copy of "reviewed" shop drawings;

.5 Complete explanation of operation principles and sequences;

.6 Complete part lists with numbers;

.7 Recommended maintenance practices and precautions;

.8 Parts manual and repair manuals

.9 Complete wiring and connections diagrams;

.10 Certificates of guarantee;

1.28.2 Ensure that operating and maintenance instructions are specific and apply to the models and types of equipment provided.

1.28.3 Submit three hard copies of the maintenance manuals in heavy-duty binders complete with as-built drawings and all instructions suitably labelled with project name and locations at project close-out. Submit three copies on USB key with all of the same contents as the hard copies of the maintenance manuals at project close-out.

1.29 TRIAL USAGE

1.29.1 The Consultant reserves the right to use any system, piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same, or for the purpose of learning operational procedures, before the final completion and acceptance of the work. Such tests shall not be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the above due to the aforementioned tests, where such injuries or

breakage are caused by a weakness or inaccuracy of parts, or by defective materials or workmanship of any kind. Supply all labour and equipment required for such tests.

1.29.2 Perform and pay for all costs associated with any testing required on the system components where, in the opinion of the Consultant the equipment manufacturer's ratings or specified performance is not being achieved.

1.30 **INSTRUCTION TO OWNERS**

1.30.1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of all systems and equipment.

1.30.2 Arrange for, and pay for services of service engineers and other manufacturer's representatives required for instruction in the operation of systems and equipment.

1.30.3 Submit to the Consultant at the time of final inspection a complete list of systems stating for each system:

.1 Date instructions were given to the Owner's staff.

.2 Duration of instructions.

.3 Name of persons instructed.

.4 Other parties present (manufacturer's representative, consultants, etc.)

1.30.4 Obtain the signature of the Owner's staff verifying that they properly understood the system installation, operation and maintenance requirements, and that they have received the specified manuals and "as-built" record drawings.

1.31 **SYSTEM ACCEPTANCE**

1.31.1 Submit original copies of letters from the manufacturers of all systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the method of installation, connection and operation.

1.31.2 These letters shall state the names of persons present at testing, the methods used, and a list of functions performed with location and room numbers where applicable.

1.32 **CLEANING**

1.32.1 Before energizing any systems, inspect and clean the inside of panel boards, switchgear, and cabinets to ensure that they are completely free from dust and debris.

1.32.2 Clean all polished, painted and plated work bright.

1.32.3 Remove all debris, surplus material and all tools

1.32.4 Carry out additional cleaning of systems as specified in other sections of this Division.

1.33 **PAINTING WORK SUPPLIED UNDER DIVISION 26**

1.33.1 Touch up minor chips or damage to electrical equipment, installed in this Division, with standard, factory supplied, enamel finish.

1.33.2 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.

1.33.3 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.

1.34 **REMOVALS**

1.34.1 Co-ordination Between New and Existing Installations

.1 Provide interfacing components between new and existing systems as necessary for proper performance and operation.

1.34.2 Existing Services

.1 Ensure existing services remain undisturbed and energized except where indicated.

.2 Disconnect and remove abandoned wiring materials and devices.

1.34.3 Modifications to Existing Structures

.1 Provide new electrical equipment to existing structures as detailed on drawings. Remove existing devices as shown and as required. Salvage existing circuits for reuse as noted.

1.34.4 Interruption of Services

.1 Maintain existing systems in existing building at all times during construction.

.2 Obtain Consultant's and Owner’s written approval before interrupting any service. Long outages are not acceptable.

.3 The Contractor shall apply to the Owner in writing for any power interruptions a minimum of two (2) weeks before requested shutdown date and obtain the Owner's written approval for any shutdowns. The Contractor shall indicate the approximate length of the shutdown and services affected in their written request for permission. Contractor shall include all costs for overtime work.

1.34.5 Premium Time

.1 Include cost of premium time in bid price for work during nights, weekends or other time outside normal working hours necessary to do the work and maintain electrical services in operation.

.2 Premium time is to include work by Alectra Utilities, ESA, and any other authorities having jurisdiction or utility owners as required.

1.34.6 Use of Existing Material And Equipment

.1 Unless noted otherwise, do not use any existing panels, boxes and wiring materials unless shown on drawings.

.2 The Owner’s equipment is not available for Contractor use. Contractor must provide all equipment required to complete the work.

1.34.7 Demolition

.1 Demolish existing work, where indicated, and remove from site.

.2 Execute all demolition work so as to create minimum vibration or dust within and outside the building. Obtain Consultant's approval of methods before proceeding.

2 **PRODUCTS**

Nil

3 **EXECUTION**

Nil

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Division 01, Tender Documents and Division 26.

1.2 REFERENCES

1.2.1 CSA International CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.

.1 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

1.2.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

1.2.3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

1.4.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.4.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

1.5.3 Storage and Handling Requirements:

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

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 PRODUCTS

2.1 MATERIALS

2.1.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

2.1.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

2.1.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

2.1.4 Provide compression connectors for reducing wire sizes to connect to circuit breakers, device leads or device terminals. Compression connectors shall be insulated at the manufacturer’s factory. The manufactured compression connectors shall be approved by ESA for use in the location in which they are installed.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

3.2.1 Remove insulation carefully from ends of conductors and cables and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.

.2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

3.3.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

3.3.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01 and Division 26.

1.2 APPLICATION

1.2.1 This Section applies to and is an integral part of all succeeding Sections of this Division of the specification.

1.3 REFERENCES

1.3.1 CSA C22.2 No. 38-M - Thermoset Insulated Wires and Cables

1.3.2 CSA C22.2 No. 75-M - Thermoplastic Insulated Wires and Cables

1.3.3 CSA C22.2 No. 127 - Equipment Wires

1.4 PRODUCT DATA

1.4.1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials in accordance with Section 01 74 00 – Cleaning and Waste Processing.

2 PRODUCTS

2.1 BUILDING AND BONDING WIRES

2.1.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.1 CSA type RW90 XLPE (-40°C)
- .1 Heat and moisture resistant
- .2 Low temperature, chemically cross-linked thermosetting polyethylene material
- .3 600V-rated
- .4 For maximum 90°C conductor temperature
- .5 For installation at minimum -40°C temperature
- .6 To CSA C22.2 No. 38

2.1.2 CSA Type AC90 XLPE (-40°C) (BX Cable):

.1 General Requirements
- .1 BX cables shall be provided with dedicated ground conductor.
- .2 BX cables shall only be installed where they can be concealed above ceiling spaces. BX cables shall not be installed elsewhere.
- .3 BX cables shall only be installed in maximum lengths of 1m to make connection from lighting branch circuit conduit run to an individual lighting fixture

.2 Conductors:
- .1 ASTM Class-B, soft drawn, electrolytic copper.
- .2 Solid for sizes number 5.26mm² (12AWG) and smaller.

.3 Stranded for sizes number 8.37mm² (10AWG) and larger.

.3 Insulation:
- .1 Heat and moisture resistant.
- .2 Low temperature, chemically cross-linked thermosetting polyethylene material.
- .3 600V rated.
- .4 For maximum 90°C conductor temperature.
- .5 For installation at minimum -40°C temperature.
- .6 CSA C22.2 Number 38.

.4 Construction:
- .1 Two, three or four insulated conductors.
- .2 Bare ground conductor.
- .3 Overall interlocking aluminum armour.
- .4 CSA C22.2 No. 51.

2.1.3 Branch circuit conductors up to and including #12 AWG shall be solid. Branch circuit conductors in sizes larger than #12 AWG shall be stranded. All branch circuit conductors shall be constructed of 90% conductive copper.

2.1.4 All cables shall be provided with insulation rated at 90 degree Celsius.

3 EXECUTION

3.1 FIELD QUALITY CONTROL

3.1.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.1.2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

3.1.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

3.2.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

3.2.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

3.2.3 Conductor length for parallel feeders to be identical.

3.2.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

3.2.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

3.2.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

3.2.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

3.3.1 Install wiring as follows:

.1 Wire and cable application and type:

Application	Type
.1 Lighting branch circuit indoors only	RW90
.2 Final 1m connection from branch circuit conduit run to lighting fixture	BX cable

3.4 INSTALLATION OF CONTROL CABLES

3.4.1 Ground control cable shield.

3.5 FIELD QUALITY CONTROL

3.5.1 Perform tests in accordance with Section 26 05 00 Common Work Results for Electrical.

3.5.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

3.5.3 Check phase rotation and identify each phase conductor of each circuit.

3.5.4 Check each circuit installation for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

3.6 TESTS

3.6.1 Branch circuit balancing: Connect all new branch power circuits to existing panelboards so as to balance the actual loads (wattage) within 5%.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01 and Division 26.

1.2 RELATED REQUIREMENTS

1.2.1 All other sections forming part of the contract documentation.

1.3 REFERENCES

1.3.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

1.3.2 OESC, Ontario Electrical Safety Code (consisting of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installation).

1.3.3 ULC, Underwriters Laboratories of Canada.

1.3.4 CSA International

.1 CSA Z32-09, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

1.5.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.5.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Clamps for grounding of conductor: size as indicated and as required to electrically conductive underground water pipe.

2.1.2 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

2.1.3 Insulated grounding conductors: green, copper conductors, size as indicated.

2.1.4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

2.1.5 Bonding connections: Copper compression barrel terminals, rated for minimum 600 V at 90°C and CSA certified when applied with tool and die combination. Two-hole terminals bolted to ground bus and equipment to be bonded.

2.1.6 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 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

3.2 INSTALLATION GENERAL

3.2.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

3.2.2 Provide bonding conductor in all conduits.

3.2.3 Install connectors in accordance with manufacturer's instructions.

3.2.4 Protect exposed grounding conductors from mechanical injury.

3.2.5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

3.2.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

3.2.7 Soldered joints not permitted.

3.2.8 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.

3.2.9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

3.2.10 Install separate ground conductor to outdoor lighting standards.

3.2.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2.12 Ground secondary service pedestals.

3.3 **EQUIPMENT GROUNDING**

3.3.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, control panels, building steel work, distribution panels, lighting fixtures.

3.4 **FIELD QUALITY CONTROL**

3.4.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.4.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.

3.4.3 Perform tests before energizing electrical system.

3.5 **CLEANING**

3.5.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning and Waste Processing.

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

3.5.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02, Division 09 and Division 26.

2 PRODUCTS

2.1 SUPPORT CHANNELS

2.1.1 Galvanized steel, size and load rating to suit application.

2.1.2 One hole steel straps to secure surface mounted conduits or surface mounted cables 50mm diameter and smaller. Two-hole steel straps for conduits and cables larger than 50mm.

2.1.3 Beam clamps to secure conduits to exposed steel work.

2.1.4 Channel type supports for two or more conduits.

2.1.5 6mm minimum diameter threaded rods to support suspended channels.

2.1.6 6mm mínimum diameter U-bolts.

2.1.7 Sleeves: Schedule-40 steel pipe minimum I.D. 13mm larger than O.D. of conduit or cable passing through.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Install all inserts, beam clamps, fasteners, and similar hardware required for conduit, duct, raceway, conductor and suchlike and equipment hanger or support materials to best suit structural details.

3.1.2 Secure equipment to poured concrete with expandable inserts. Accurately and properly set concrete inserts in the concrete framework.

3.1.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

3.1.4 Where inserts are required in concrete work where concrete inserts have not been installed, drill a neat hole of the proper diameter and depth in the concrete and insert an anchor to accept the hanger rod, bolt and suchlike or where concrete mass permits, use self-drilling concrete anchors.

3.1.5 Fasten hangers and support provisions to brick or masonry with expansion shields and machine bolts, or for light loads, use plugs and screws.

3.1.6 In cavity walls and ceilings use two wing toggles and for heavy loads, provide steel anchor plates with two or more toggles to spread the load.

3.1.7 Provide beam clamps for attaching, hanging or support provisions to the Consultant, weld the hanging and support provisions to the structural steel.

3.1.8 Explosive power actuated fasteners will not be permitted unless specific approval for their use has been obtained from the Consultant.

3.1.9 Securely mount plywood backboards to structure or use independent mounting channels, secured to floor.

3.1.10 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

3.1.11 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.

3.1.12 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

3.1.13 For runs of three or more conduits, raceways, or conductors in concrete formwork, use multiple type inserts used for the smallest conduit in the group.

3.1.14 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

3.1.15 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

3.1.16 Do not use wire lashing or perforated strap to support or secure raceways or cables.

3.1.17 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

3.1.18 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.1.19 Ensure support hardware is bonded to ground.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents Division 01 and Division 26.

1.2 REFERENCES

1.2.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware

.2 CSA C22.2 No. 56, Liquid-tight Flexible Metal Conduit

.3 CSA C22.2 No. 83, Electrical Metallic Tubing (EMT).

1.3 SUBMITTALS

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

1.3.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

1.3.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

2 PRODUCTS

2.1 CONDUITS

2.1.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, galvanized cold-rolled steel tubing with set-screw connectors or watertight couplings based on room in which conduit is installed. Set screw connectors are not allowed in rooms without suspended ceiling or in rooms below grade. Use watertight couplings in rooms without suspended ceiling or in rooms below grade.

2.1.2 Liquid Tight Flexible Steel Conduit

.1 To CSA 22.2 No. 56.
.2 Liquid-tight flexible steel conduit with PVC cover.
.3 Watertight connectors with nylon insulated throat.

2.1.3 All conduit must have adequate support systems complete with approved fittings, outlet boxes, junction boxes, sealing fittings and drains as indicated or as required. Provide hot dipped galvanized steel beam clamps, hot dipped galvanized steel channel type supports where required. Provide 6mm threaded galvanized steel rods to support

suspended channels and provide all necessary galvanized steel spring loaded bolts, nuts, washers and lock washers.

2.2 **CONDUIT FASTENINGS**

2.2.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

2.2.2 Beam clamps to secure conduits to exposed steel work.

2.2.3 Channel type supports for two or more conduits at spacing required by code.

2.2.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 **CONDUIT FITTINGS**

2.3.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

2.3.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

2.3.3 Set-screw connectors and couplings for EMT for areas with suspended ceilings.

2.3.4 Watertight connectors and couplings for EMT for rooms without suspended ceiling or in rooms below grade.

2.3.5 Set screw connectors are not allowed in rooms without suspended ceiling or in rooms below grade. Use watertight couplings in rooms without suspended ceiling or in rooms below grade.

2.4 **EXPANSION FITTINGS FOR RIGID CONDUIT**

2.4.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

2.4.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

2.4.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 **PULL ROPE**

2.5.1 Pull rope shall be polypropylene of 5 kN tensile strength. 6.35mm (¼") pullrope.

2.6 **CONDUIT SEALING COMPOUNDS**

2.6.1 Compatible with all common jacket materials.

2.6.2 Fast set time

2.6.3 Excellent mechanical adhesion to conduits and cables.

2.6.4 Excellent water resistance.

2.6.5 Re-enterable.

2.6.6 Formulated to perform in temperatures ranging from 20º to 100º F.

3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

3.1.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

3.2.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.2.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

3.2.3 Use electrical metallic tubing (EMT) indoors in dry areas and not subject to mechanical injury.

3.2.4 BX cables shall only be used in accordance with requirements of Specification Section 26 05 21 paragraph 2.1.2.1.

3.2.5 Liquid-tight conduit shall only be used for connections to the lighting fixtures or vibrating equipment. Liquid-tight conduit length shall not exceed 1m.

3.2.6 Provide factory-manufactured transition couplings between different types of conduits appropriate to the two conduits being connected.

3.2.7 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.2.8 Mechanically bend steel conduit over 19 mm diameter.

3.2.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.2.10 Install fish cord in empty conduits.

3.2.11 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

3.2.12 Dry conduits out before installing cables.

3.2.13 Provide factory elbows and couplings for conduits.

3.3 CUTTING AND PATCHING

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

3.3.2 Repair damaged or otherwise affected surfaces to match condition of existing adjacent surfaces prior construction.

3.4 PENETRATIONS IN EXISTING STRUCTURE

3.4.1 Perform cutting, patching and repairing. Obtain Consultant's approval before proceeding.

3.4.2 Where necessary to penetrate existing floors, walls, ceiling, roof or structural members provide sleeve and follow Consultant's instructions.

3.4.3 Restore surfaces to same finish and condition as existed prior to penetration.

3.4.4 Core Drilling Procedure

.1 Contractor must notify City of Mississauga a minimum of two (2) days prior any coring so arrangements can be made at the facility.

.2 Examine locations to be core drilled where:

.3 Diameter is greater than 25 mm

.4 Multiple drillings required and where the distance between centres is less than 10 times the diameter of the hole

3.4.5 Examine by most suitable method including:

.1 Contractor must notify City of Mississauga a minimum of two (2) days prior any scanning for the purposes of coring so arrangements can be made at the facility.

.2 X-ray

.3 Ferro scan

.4 Cable detection

3.4.6 Examine from both sides of the structure to be drilled.

3.4.7 Examine proposed core drilling locations to determine:

.1 Possible interference with
- .1 Services
- .2 Structural components

3.4.8 Select locations as suitable for core drilling and label them:

.1 Uniquely number each drilling location and core so that markings will be legible after drilling

.2 Mark each core with a north pointing arrow where drilling a slab or upward pointing arrow where drilling a wall

3.4.9 Without interfering with or damaging any services or structural elements, drill pilot holes sufficient to verify location of potential obstructions or for alignment purposes.

3.4.10 Use impact drill when drilling holes of 25 mm diameter or less. For holes of greater diameter use core drill. Contractor must notify City of Mississauga a minimum of two (2) days prior any impact drilling so arrangements can be made at the facility.

3.4.11 Prepare report showing intended core drill locations including printouts, X-ray images. Submit the report for approval prior to drilling to Consultant.

3.4.12 Proceed with core drilling only after approval has been received from Consultant.

3.4.13 Confine drilling operation to time-of-day as stipulated by Consultant.

3.4.14 Position suitable warning notices of a type acceptable to Consultant and exercise caution to ensure safety and protection of personnel and property during drilling especially from effects of water, dust damage, or falling objects below the slab or behind the wall being drilled.

3.4.15 Stop drilling immediately, and report to Consultant, if contact is made with foreign objects such as reinforcing steel (rebar), electrical conduit, water pipes, drainage pipes.

3.4.16 Cover open holes with secured covers to guard against fall through of objects.

3.4.17 Provide necessary firestopping, temporary or otherwise, sufficient to firestop holes that would be otherwise open during hours that the location is unattended. Coordinate placement of firestopping with Consultant.

3.4.18 Store all cores or core fragments on site and make them available for inspection by Consultant. Dispose of the cores or core fragments after permission is received from Consultant.

3.5 **INSTALLATION OF SLEEVES**

3.5.1 Where conduits, raceways and conductors pass through structural poured concrete, install sleeves, to suit structural details.

3.5.2 Size sleeves, unless otherwise noted, to leave 12mm clearance around the conduit, raceway, etc. Pack and seal the void between the sleeves and the conduit, raceway, conductor etc. for the length of the sleeves as follows:

.1 Pack sleeves set in interior concrete slabs, masonry walls, fire rated partitions, etc., with a U.L.C. and C.S.A. approved fire barrier caulk equal to 3M #CP25.

.2 Pack sleeves set in exterior walls with lead wool or oakum and seal the ends of the sleeves water-tight with an approved non-hardening sealant compound. Co-ordinate with the waterproofing trade.

.3 Submit to the concrete reinforcement detailed at the proper times, drawings, indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and shall relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.

.4 Install sleeves of a water protecting type in the following locations:
.1 In Mechanical Room floor slabs except where on grades.
.2 In slabs over Mechanical, Fan, Electrical and Telephone equipment rooms or closets.
.3 In all floors equipped with waterproof membranes.
.4 In the roof.

.5 "Gang" type sleeving will be permitted only with the Consultant's approval. All sleeves locations in precast slabs shall be approved by structural Engineer.

.6 Terminate sleeves for work which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeves may be completely covered by escutcheon plates.

.7 Openings for multiple conduit or conductor runs, etc., will be provided by the Division responsible for the particular construction in which the opening is required. Carefully co- ordinate the opening locations with the particular Division and ensure that openings are suitably sized and located. Seal the space between the opening and the conduit, conductors, etc., for the length of the opening as for sleeves above.

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

3.6 INSTALLATION OF INSERTS, BEAM CLAMPS, FASTENERS, HANGERS AND SUPPORTS

3.6.1 Install all inserts, beam clamps, fasteners, and similar hardware required for conduit, duct, raceway, conductor, etc., and equipment hanger and/or support materials to best suit structural details.

3.6.2 Accurately and properly set concrete inserts in the concrete framework.

3.6.3 For runs of three (3) or more conduits, raceways, or conductors in concrete formwork, use multiple type inserts used for the smallest conduit in the group.

3.6.4 Where inserts are required in precast concrete and in concrete work where concrete inserts have not been installed, drill a neat hole of the proper diameter and depth in the concrete and insert an anchor to accept the hanger rod, bolt, etc., or where concrete mass permits, use self-drilling concrete anchors.

3.6.5 Fasten hangers and support provisions to brick or masonry with expansion shields and machine bolts, or for light loads, use plugs, and screws.

3.6.6 In cavity walls and/or ceilings use two (2) wing toggles and for heavy loads, provide steel anchor plates with two (2) or more toggles to spread the load.

3.6.7 Provide beam clamps for attaching, hanging and/or support provisions to the Consultant, weld the hanging and support provisions to the structural steel.

3.6.8 Explosive power actuated fasteners will not be permitted unless specific approval for their use has been obtained from the Consultant.

3.6.9 Securely mount plywood backboards to structure or use independent mounting channels, secured to floor.

3.7 SURFACE CONDUITS

3.7.1 Run parallel or perpendicular to building lines.

3.7.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

3.7.3 Run conduits in flanged portion of structural steel.

3.7.4 Group conduits wherever possible on surface channels.

3.7.5 Do not pass conduits through structural members except as indicated.

3.7.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.7.7 Fasten conduit with malleable PVC coated galvanized steel two-hole straps at intervals to suit code requirements and job conditions.

3.8 TEST AND INSPECTION

3.8.1 Give Owner at least 1 week written notice of time to witness testing.

3.8.2 Test insulation on installed cable using "megger" type insulation testing equipment.

3.8.3 Acceptance tests shall include leakage test of cables, when applicable, according to Insulated Power Cables Engineers Association (IPCEA) recommendations, with all tests recorded for submission to Owner.

3.9 CLEANING

3.9.1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Processing.

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

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 09 and Division 26.

1.2 SCOPE OF WORK

1.2.1 Supply all labour, tools, services and equipment and provide all materials and equipment required for lighting control systems in accordance with this section of the specification and the Contract Drawings.

1.3 REFERENCES

1.3.1 Underwriters Laboratories (UL):

.1 UL 508 - Industrial Control Equipment American National Standards Institute (ANSI)

.2 UL 924 - Emergency Lighting and Power Equipment

1.3.2 National Fire Protection Association (NFPA):

.1 NFPA 70 - National Electric Code

1.3.3 American National Standards Institute (ANSI):

.1 ANSI E1.11-2008 USITT DMX512-A - Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories

.2 ANSI E1.20-2006 - Remote Device Management over USITT DMX512

1.3.4 IEC 61000-4-2 Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques-Electrostatic Discharge Immunity Test; 2008

1.4 QUALITY ASSURANCE

1.4.1 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.

1.4.2 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval label.

1.4.3 Provide all products and services in accordance with the following codes and standards:

.1 OESC - Ontario Electrical Safety Code

.2 CSA - Canadian Standards Association

.3 UL/C - Underwriters' Laboratories of Canada

1.5 SUBMITTALS

1.5.1 Refer to Division 1 General Requirements and submit shop drawings for the following:

.1 Lighting Control System Touchscreen Interface Panel

.2 Occupancy Sensors

.3 Relay Power Packs

.4 Dimming Switches

2 PRODUCTS

2.1 RELAYS

2.1.1 UL Listed 30 Amp, Latching, 18,000 SCCR, 120VAC Ballast and HID and 20 Amp Tungsten at 120VAC.

2.1.2 Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two number 8.37mm² (8AWG) wires on both the line and the load side. Systems that do not allow for individual relay replacement or additions are not acceptable.

2.1.3 Relays to be rated for 250,000 operations minimum at a full 30A lighting load, default to closed at normal power loss, Normally Closed Latching (NCL).

2.1.4 Optional relay types available shall include Normally Open Latching (NOL) relay rated for 250,000 operations, a 600V two-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

2.2 LOW VOLTAGE SWITCHES

2.2.1 The switches shall accept CAT6 cable.

2.2.2 Contact closure style switches shall not be acceptable. The programming for a digital switch will reside in the switch itself, via double erasable programmable read-only memory (EPROM). Any digital switch button function shall be able to be changed locally or remotely via modem, Internet or Ethernet.

2.2.3 Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. System shall provide capability to locally and remotely program each individual switch button, monitor and change function of each button locally and remotely. Each button shall be capable of being programmed for ‘On’ only, ‘Off’ only, ‘On/Off’ (toggle), ‘Raise’ (Dim up) and ‘Lower’ (Dim down). Switches requiring low voltage control wires to be moved from one input terminal to another to accomplish these functions are not acceptable.

2.2.4 Keyed switches shall be programmable and connect to the lighting controls system bus.

2.2.5 All programming shall be done locally or remotely via dial up modem or web interface as described in other paragraphs of this section. Each touch pad shall be identified as to function by an engraved label. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cm spark) without any interruption or failure in operation.

2.2.6 Switch Stations shall provide manual switching of lighting load(s) controlled by a relay or group of relays.

2.2.7 Switches shall be low voltage, momentary switches and shall be available with quantity of buttons required for specified sequences of operations and dimming. Buttons shall have LED indicators. The switch stations shall be available in white (WH) or ivory (IV) colour and the finish shall be co-ordinated with the architect.

2.2.8 Switches shall be injection molded and designed to mount in a standard single gang junction box with standard decorator-style plate opening.

2.2.9 Switches shall have removable buttons for field replacement. Button replacement may be completed without removing the switch from the wall.

2.2.10 Switches with LED indication shall have a green LED that is illuminated when the switch is in the ON state.

2.2.11 Switches shall be programmable from the lighting control panel user interface or remotely.

2.2.12 Switches shall have 4” low voltage CLASS 2 leads for connection to lighting control panel or power pack inputs. The switch shall have wiring diagram indicated by a label affixed to the switch housing. Dimming switches shall connect to the panel or power-pack via standard CAT6 cable and connectors. The switches shall be low voltage and shall not connect to line voltage power wiring.

2.2.13 Switches shall be capable of continuously dimming fixtures with no sudden changes in light level (i.e. large steps) or other visually irritating means of raising or lowering light levels.

2.2.14 The low voltage switch shall be provided complete with an on/off button to turn off all lights in all zones controlled by the switch.

2.2.15 The low voltage switch shall be provided sufficient buttons dedicated for each zone for raising and lowering the dimming level in each zone.

2.2.16 The low voltage switch shall be suitable for connection to multiple zones controlled by multiple dimming power packs. Provide CAT6 splitter modules in junction boxes for this purpose.

2.2.17 Provide boxes for mounting dimming switches in walls. Co-ordinate finished installations with Architect. Co-ordinate faceplate and equipment finishes with architect.

2.2.18 The low voltage switches shall be Acuity Controls Sensorswitch nPODM or approved equivalent by Cooper Controls, Wattstopper, Hubbell, Leviton or Lutron.

2.3 OCCUPANCY SENSORS

2.3.1 The occupancy sensor shall accept CAT6 cable.

2.3.2 The occupancy sensors shall be dual technology type complete with passive infrared visual sensing and ultrasonic sound sensing.

2.3.3 The occupancy sensors shall use passive infrared technology and a segmented Fresnel lens to detect occupancy. The lens shall divide the field of view into zones and whenever the zones are occupied, the lights shall be switched or remain on.

2.3.4 The occupancy sensors shall be capable of detecting small hand movements to prevent nuisance turning off.

2.3.5 The occupancy sensor dimming wall switches shall be equipped with ultra-sonic sensors that deliver a high degree of motion sensitivity. The occupancy sensor dimming wall switches shall be capable of sensing Doppler shifts caused by motion in a space and prevent lighting fixtures from turning off even if the movement is outside of

the visual sensor's field of view. The ultrasonic sensors shall be provided with enhanced filtering to prevent non-occupant noises from keeping lights on.

2.3.6 The occupancy sensors be equipped with a delayed-off function to prevent the controlled lights from being switched off while the field of view is occupied. The occupancy sensors shall be equipped with an LED indicator that blinks each time activity is detected in the field of view. The occupancy sensors shall switch controlled lights off when the space monitored by the occupancy sensors is unoccupied for the length of time chosen as the delayed-off interval.

2.3.7 The ambient light override shall be adjustable between 21.5 lux to 5381 lux and shall prevent controlled lights from automatically turning on during periods of ample natural light.

2.3.8 The occupancy sensors shall be equipped with push buttons for programming, adjustment and time delay input.

2.3.9 The occupancy sensor dimming switches shall be Acuity Controls Sensorswitch nCM PDT Series or equivalent product by Cooper Controls, Hubbell, Leviton or Lutron.

2.4 POWER PACKS

2.4.1 Power packs shall accept and switch 120 or 347VAC, be plenum rated, and provide Class-2 power for up to 14 remote sensors.

2.4.2 Power pack shall securely mount to junction location through a threaded 13mm chase nipple. Plastic clips into junction box shall not be accepted. All Class-1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

2.4.3 When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class-1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

2.4.4 Power pack shall incorporate a Class-1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20A switching of all load types and be rated for 400,000 cycles.

2.4.5 Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

2.4.6 The power packs shall be Acuity Controls Sensorswitch nPP16 EFP series or equivalent product by Cooper Lighting, Hubbell, Leviton or Lutron.

2.5 TOUCH-SCREEN LIGHTING CONTROL INTERFACES

2.5.1 Liquid crystal display (LCD) touchscreen lighting control interfaces shall be provided in accordance with the following requirements:

.1 On screen lighting design and setup with no external/remote computer required.

.2 Controller shall be capable of forward and reverse phase dimming, 0-10 Vdc, DMX (RGB/Tunable White), lighting control interfaces embedded in lighting fixtures, lighting control relay power packs, and digital addressable lighting interfaces (DALI).

.3 The application for this Contract shall be communication with lighting control interfaces embedded in lighting fixtures. The lighting control interface shall be connected to fixtures serially connected (daisy-chained) on a data bus composed of CAT6 cable. The touch screen controller shall be capable of controlling the data bus no matter where it is installed in the chain.

.4 The touch screen controller shall be equipped with two (2) RJ45 ports for connection to incoming and outgoing CAT6 cables for purpose of controlling lighting fixtures with embedded control interfaces. The RJ45 ports shall provide 40mA power and communication to the lighting control interfaces embedded in the lighting fixtures.

.5 The maximum number of lighting fixtures with embedded lighting control interfaces that shall be controlled by a touch-screen controller shall be one hundred and twenty (120). Provide the quantity of lighting control interfaces to serve the quantity of lighting fixtures with embedded lighting control interfaces.

.6 Touch-screen controller shall be installed in wall in 3-gang back box with mounting ring.

.7 Touch-screen controller shall be provided with remote power supply for conversion from 120VAC input to 18-24Vdc for device.

.8 Touch-screen controller shall comply with the following standards and protocols:
.1 FCC Part 15
.2 IEC61000-4-2, +/-16kV air discharge
.3 ANSI E1.11-2008 DMX, ANSI E1.20-2006 RDM
.4 IEEE 802.15 Bluetooth
.5 IEEE 802.3 Ethernet
.6 RoHS compliant
.7 ISO 16484-5 BACnet/IP

.9 Touch-screen controller shall have been tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2 Level 4

.10 Power Failure Memory: automatically store system settings and recover from a power failure without requiring user input

.11 Electrolytic capacitors operate at least 36 degrees F (20 degrees C) below the capacitor’s maximum temperature rating when the device is under full load

.12 Inrush tolerance: Use MOSFET that has a maximum rating of six times the operating current of the dimmer/relay

.13 Surge tolerance: Panels are designed and tested to withstand surges of 6,000V, 3,000A according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance

.14 Electrolytic capacitors operate at least 36 degrees F (20 degrees C) below the capacitor’s maximum temperature rating when the device is under full load

.15 Inrush tolerance: Use metal oxide semi-conducting field effect transistor (MOSFET) that has a maximum rating of six times the operating current of the dimmer/relay

.16 Surge tolerance: Panels are designed and tested to withstand surges of 6,000V, 3,000A according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance

.17 Capacitive LCD backlit touchscreen shall be capable of multi-touch control.

.18 Touch-screen controller viewable area shall be 7.0 in (178 mm) diagonal.

2.5.2 Liquid crystal display (LCD) touchscreen lighting control interfaces shall be Acuity Controls Fresco or approved equivalent by Cooper, Hubbell, Leviton or Lutron.

3 EXECUTION

3.1 GENERAL

3.1.1 Equipment Installation

.1 Switches and control panels: Provide outlet boxes, single or multi-gang, at locations shown on the Contract Drawings for the low voltage digital switches. Mount switches as per Contract Drawings. Supply faceplates per Specifications. Supply and install the required low voltage cable, Category 6, four twisted pair, with RJ-45 connectors and snagless boots (commonly referred to as Cat-6 patch cable) between all switches and panels. Field-test all Cat-6 patch cable with a recognized cable tester. All low voltage wire to be run in conduit.

.2 Wiring:

.1 Do not mix low voltage and high voltage conductors in the same conduit. No exceptions.

.2 Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.

.3 Place manufacturer supplied “terminators” at each end of the system bus per manufacturer’s instructions.

.4 Neatly lace and rack wiring in cabinets.

.5 Provide dedicated junction boxes for the power packs. Label the power pack junction boxes with the circuits from which they are fed.

.6 Plug in Cat-6 patch cable that has been field-tested with a recognized cable tester, at the indicated RJ-45 connector provided at each lighting control device, per manufacturer’s instructions.

.7 Use Cat-6 patch cables for all system low voltage connections. Additional conductors may be required to compensate for voltage drop with specific system designs. Use shielded cable for dry contact inputs to lighting control system.

.8 All items on the bus shall be connected in sequence (daisy chained). Star and spur topologies are not acceptable.

.9 The lighting control system shall be installed by the Contractor who shall make all necessary wiring connections to external devices and equipment, to include photocells. Wire shall be as per manufacturer instructions.

.10 Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to approved shop drawings for location of line and low-voltage areas. It is the responsibility of the Contractor to verify with lighting control manufacturer all catalogue information and specific product acceptability.

.11 Support CAT6 cables in ceiling space using j-hooks and other means so the installations are safe. Do not rest CAT6 cables on ceiling tiles, ceiling tile grid or gypsum board. CAT6 cables shall be run at ceiling slab level in conduit or suspended from j-hooks before terminating securely at lighting fixtures.

.3 Sensors:

.1 Provide all necessary supports required for mounting occupancy and daylight sensors so that they operate properly for the intended programmed sequences at various areas. Comply with manufacturer's installation and calibration instructions. Co-ordinate mounting, wiring and programming of the sensors with the installation of the ceiling.

3.2 **SET-UP**

3.2.1 For digital switches provide wiring required by system manufacturer.

3.2.2 Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.

3.2.3 Panels shall be located so that they are readily accessible and not exposed to physical damage.

3.2.4 Panel locations shall be furnished with sufficient working space around panels to comply with the Ontario Electrical Safety Code.

3.2.5 Panels shall be securely fastened to the mounting surface by at least four points.

3.2.6 Unused openings in the cabinet shall be effectively closed.

3.2.7 Cabinets shall be grounded as specified in the Ontario Electrical Safety Code.

3.2.8 Lugs shall be suitable and listed for installation with the conductor being connected.

3.2.9 Maintain the required bending radius of conductors inside cabinets.

3.2.10 Distribute and arrange conductors neatly in the wiring gutters..

3.2.11 Comply with energy code lighting control system "Acceptance Requirements". Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly. This is the installing Contractor's responsibility. Verify requirements with the Owner.

3.2.12 Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original to be given to the Owner, copies placed inside the door of each lighting control panel (LCP).

3.3 **SERVICE SUPPORT AND TRAINING**

3.3.1 Start Up: Contractor shall contact manufacture to schedule commissioning of the system.

3.3.2 Telephone factory support shall be available at no additional cost to the Owner both during and after the warranty period from the date of Substantial Completion specified in the Tender Documents. The manufacturer, at no added cost, shall provide

additional remote programming via modem as required to the Owner for the operation life of the system. Upon request by the Owner, the manufacturer shall provide remote dial up software at no added cost to system the Owner. No exceptions.

3.3.3 Once the system is commissioned and accepted by the Consultant, the Contractor will provide a two (2) hour on-site training session by a factory trained technician, which will cover system operation, maintenance, troubleshooting and tour of the system. Contractor will coordinate with the Owner to determine the date and time of training.

3.4 **CLEANING**

3.4.1 Clean sensor lens as recommended by manufacturer.

3.4.2 Clean all switch faceplates.

3.5 **COMMISSIONING OF THE LIGHTING SYSTEM**

3.5.1 Adjust the dimming output of the lighting fixtures to the satisfaction of the Owner.

3.5.2 Address fixtures in touchscreen controller interface to the satisfaction of Owner. Provide Owner with plan and Microsoft Excel file for each fixture number and its dimming settings. Provide mark-up of lighting plan showing same numbers of the lighting fixtures as the Excel sheet and programmed settings in the Controller.

3.5.3 Demonstrate operation and programming of the touchscreen controller and switches to the Owner so they can adjust the dimming settings of the fixtures in the touchscreen controller and switches to their satisfaction in the future without factory personnel.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02 and Division 26.

1.2 REFERENCES

1.2.1 Section 26 05 00 Common Work Results for Electrical also applies to and is a part of this Section of the Specification.

1.2.2 Conform to latest issues, amendments and supplements of following standards:

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.2 ANSI/IEEE C62.41, Recommended Practices for Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.4 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.5 United States of America, Federal Communications Commission (FCC)

.6 FCC (CFR47) EM and RF Interference Suppression.

.7 CSA C22.2 No. 9.0 General Requirements for Luminaires

.8 CSA C22.2 No. 66.1 Low Voltage Transformers - Part 1: General Requirements

.9 CSA C22.2 No. 66.2 Low Voltage Transformers - Part 2: General Purpose Transformers

.10 CSA C22.2 No. 66.3 Low Voltage Transformers - Part 3: Class 2 and Class 3 Transformers

.11 CSA C22.2 No. 141 Emergency Lighting Equipment

.12 CSA C22.2 No. 250.0 Luminaires

.13 IEEE C62.41 Recommended Practices for Surge Voltages in Low-voltage AC Power Circuits

.14 UL 1598 Luminaires

.15 UL 8750 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.3 SCOPE OF WORK

1.3.1 Supply all labour, tools, services and equipment and provide all materials and equipment required for a complete lighting system in accordance with this section of the specification and the drawings.

1.3.2 Provide the services of a lighting restoration company to convert the natural gas-fired luminaires to electric LED luminaires meeting CSA requirements.

1.4 **QUALITY ASSURANCE**

1.4.1 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.

1.4.2 All equipment shall carry the CSA or the UL/C label or the contractor shall obtain Electrical Safety Authority approval label.

1.4.3 Provide all products and services in accordance with the following codes and standards:

.1 OESC - Ontario Electrical Safety Code

.2 CSA - Canadian Standards Association

.3 UL/C - Underwriters' Laboratories of Canada

1.5 **SUBMITTALS**

1.5.1 Refer to Division 1 General Requirements and submit shop drawings for the following:

.1 Lighting Fixtures

1.5.2 Submit certified copies of photometric test data, for each luminaire type, prepared by independent testing laboratory. Photometric data to include total input watts, candlepower summary, candlepower distribution, zonal lumen summary, luminaire efficiency, coefficient of utilization table, lamp type, ballast type and manufacturer, and lumen rating in accordance with IESNA testing procedures.

1.5.3 Photometric data to include spacing criterion.

1.5.4 Provide photometric calculations for all areas at which lighting is replaced in the shop drawing submission. The photometric calculations shall use the lighting fixture selections presented in the shop drawing submission.

1.6 **INSPECTION AND TESTING PROCEDURES**

1.6.1 All testing shall be done with entire facility illuminated.

1.6.2 Horizontal footcandle readings shall be taken with the meter positioned horizontal 760mm above the finished floor.

1.6.3 Testing equipment for measurement of footcandle levels shall be a calibrated instrument. Submit the certificate of calibration for the lighting level meter as a shop drawing submission.

1.6.4 For final approval of the project the manufacturer shall provide a final report from the test results that shall provide the following items:

.1 Identification of number and location of the test stations.

.2 Actual horizontal footcandle readings taken at each test station.

.3 Number of hours of operation.

2 PRODUCTS

2.1 LIGHTING FIXTURES

2.1.1 Interior LED Luminaires:

.1 Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

.2 Each luminaire shall be rated for a minimum operational life of 50,000 hours as defined by IES LM-80 and TM-21. LED fixtures shall provided with 0- 10VDC dimming.

.3 Each luminaire shall be designed to operate at an average operating temperature of 25°C.

.4 The operating temperature range shall be -10°C to +25°C.

.5 Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average operating temperature.

.6 The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

.7 Each luminaire shall be listed with a nationally recognized testing laboratory (including but not limited to UL, CSA, ETL) under UL 1598 and UL 8750, or an equivalent standard from a recognized testing laboratory.

.8 The luminaire shall operate from a 60 HZ ±3 HZ AC line over a voltage ranging from 110 volt to 347 volt (as specified in Lighting Fixture Schedule). The fluctuations of line voltage shall have no visible effect on the luminous output.

.9 The luminaire shall have a power factor of 0.90 per cent or greater at all standard operating voltages

.10 Total harmonic distortion (THD) (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 per cent at any standard input voltage.

.11 The lumen output shall not decrease by more than 20 per cent over the minimum operational life The lumen output shall not decrease by more than 20 per cent over the minimum operational life.

.12 Light Color/Quality:
- .1 Corrected Color temperature (CCT) range between 3,500K and 4,100K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the two-D CIE chromaticity chart .
- .2 The color rendition index (CRI) shall be 80 or greater.

.13 The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life

.14 The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit.

.15 The assembly and manufacturing process for the Solid-State Lighting luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.

.16 The optical assembly of the luminaire shall consist of a ribbed metal reflector system and extruded refracting optical lens with high-transmission internal diffusion film applied to the inside of the refracting lens. No individual LED images shall be visible to the occupant.

.17 The electronics/power supply enclosure shall be internal to the Solid-State Lighting luminaire and be accessible per UL requirements

.18 Electrical connections between power, driver and LED boards must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation from the room side and all electrical components must to be able to be replaced without removing the fixture from the ceiling.

.19 Housings shall be fabricated from post or pre-painted cold rolled steel.

.20 Each refractor or lens shall be made from UV inhibited high impact plastic (such as acrylic or polycarbonate) or heat and impact resistant glass,

.21 Polymeric materials (if used) of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. The lenses (lens) of the luminaire are excluded from this requirement.

.22 Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside the each unit.

.23 The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in Watts and Volt-Ampere.

.24 The luminaires shall be equipped with a built-in lighting control interface with input and output RJ45 ports so fixtures can be integrated into a data bus for control by touchscreen controller. Lighting fixture control inputs can be daisy-chained together using CAT6 cables.

.25 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the Luminaires for a period of five (5) years after acceptance of the Luminaires. Replacement Luminaires shall be provided promptly after receipt of Luminaires that have failed at no cost to the customer. All warranty documentation shall be provided to the Owner.

.26 The fixtures shall be listed on the DesignLights Consortium and EnergyStar Qualified Products List.

3 EXECUTION

3.1 GENERAL

3.1.1 General

.1 Remove the lighting fixtures complete with lamps, ballasts and accessories shown to be removed on the drawings and transport the equipment for safe disposal/recycling at an accredited facility. Provide certificate for safe disposal/recycling of existing equipment to Owner.

.2 Provide supports for luminaires. For continuous row lighting, provide support for each end plus at least one for each channel section, or additional as required. Swivel mount stems. Provide concrete inserts at points of luminaire support in unfinished areas where a concrete slab serves as ceiling. Provide support from concrete floor and uni-strut channel mounted to roof steel above ceiling as applicable.

.3 Align luminaires in rows, maintain required heights, and install luminaires clear of other Work.

.4 Keep luminaires covered and protected from construction dust and debris until building is broom clean and free of suspended dust clouds.

.5 When installation is complete, demonstrate operation to satisfaction of Owner.

.6 Support luminaires in an approved manner to comply with the Ontario Electrical Safety Code and the Ontario Building Code.

.7 Provide steel luminaire studs, brackets and hangers. Where luminaires are hung on chain hangers, provide chain of closed link type capable of supporting ten times luminaire weight. Use U bolts for chain ends; S hooks are not acceptable.

.8 Protect equipment from dust, debris, moisture, and physical damage, with sealed envelope of plastic or other impervious material until building is enclosed and cleaned and equipment is energized.

.9 Protect from condensation by maintaining at suitable temperature above 0 degrees Celsius. The equipment shall not be damaged as a result of conditions of storage and Owner will not pay for new equipment as a result of weather damage.

3.1.2 Start-up and Commissioning

.1 Refer to Specification Section 26 09 23 for commissioning of lighting fixtures that are controlled by control devices.

END OF SECTION

1.0 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Comply with the Region of Niagara General Conditions, Tender Documents, Division 01, Division 02 and Division 26.

1.2 REFERENCES

1.2.1 Comply with Electrical General Provisions Section 26 05 00 and all other documents referred to therein.

1.2.2 Supply all labour, tools, services and equipment and provide all the materials required to complete this section of the work.

1.2.3 All work in conjunction with this installation shall meet the minimum requirements of the following Codes, Standards and Governing Authorities.

.1 CAN/ULC S524 Installation of Fire Alarm Systems.

.2 CAN/ULC S536 Inspection and Testing of Fire Alarm Systems.

.3 CAN/ULC S537 Verification of Fire Alarm Systems.

.4 Ontario Electrical Safety Code.

.5 Ontario Building Code

1.3 SUBMITTALS

1.3.1 Submit shop drawings in accordance with Section 01330 for the following and prior to commencing installation. Do work in accordance with reviewed shop drawings.

1.3.2 Systems functional description, and sequence of operation.

1.3.3 Provide the battery sizing calculations in the shop drawing submission.

1.4 QUALITY ASSURANCE

1.4.1 All components shall be C.S.A. and/or U.L.C. approved listed and labelled.

1.4.2 Execute work of this section using skilled tradesmen experienced in each of the specialized systems.

1.5 DESCRIPTION

1.5.1 This section of the specification includes the furnishing of services to temporarily decommission portions of a fire alarm system to remove an existing ceiling and restore the portions to service after the ceiling has been replaced.

1.5.2 The installing company shall employ qualified Fire Alarm Technicians on site to guide the final checkout and to ensure the systems integrity.

1.6 SCOPE OF WORK

1.6.1 Existing fire alarm system shall be operational during construction. Provide all necessary equipment, wiring, conduits, temporary power and other accessories as required to meet this requirement.

1.6.2 The existing fire alarm control panel is a non-addressable Edwards Fireshield Plus and shall be reused.

1.6.3 Temporarily decommission and remove from service existing portions of the fire alarm system to suit the ceiling demolition and replacement work while keeping the fire alarm system operational outside the current work area. Restore all existing fire alarm system devices to service after ceiling replacement in each work area is completed. There shall never be impairment of fire alarm system operation outside a single work area.

1.6.4 The contractor shall provide the services of a fire alarm system installer certified by the fire alarm system manufacturer to perform the work.

1.6.5 Supply and install fire alarm devices as indicated on the drawings. All devices shall be fully compatible with the existing fire alarm system and shall be approved by the manufacturer of the fire alarm system.

1.6.6 Ensure equipment manufacturer provides information regarding wiring requirements. Provide for the verification and testing of any and all system devices as necessary to satisfy the Authority Having Jurisdiction.

1.6.7 A factory-authorized installer is to perform the Work of this section.

1.6.8 The modification to the existing system shall consist of all necessary hardware equipment and software programming as required.

1.6.9 This contractor is responsible to provide the required infrastructure conduits, wires, (red) back boxes and connections to all fire alarm devices shown on plan and installed under this project.

1.6.10 Provide programming, testing and verification of system devices as necessary to satisfy the Authority Having Jurisdiction. Include complete verification report and certification in closeout manuals.

1.6.11 All equipment and components shall be new and the manufacturer's current model unless otherwise specified.

1.6.12 Provide As-built drawing of project area to show all fire alarm equipment quantity and location.

1.7 ACCEPTABLE MANUFACTURERS

1.7.1 Being listed as an acceptable Manufacturer in no way relieves obligation to Provide all equipment and features in accordance with these Specifications.

1.7.2 Acceptable Manufacturers:

.1 Edwards (Raytheon (UTC))

1.8 SUBMITTALS

1.8.1 General:

.1 Submit shop drawings in digital format.

.2 Submit fire alarm system verification report in digital and hard copy formats.

.3 All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance,

function and quality. Equivalent compatible ULC listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.

.4 All substitute equipment proposed as equal to the equipment specified herein, shall meet or exceed the following standards. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

1.8.2 Software Modifications

.1 Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.

.2 Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications onsite. Modification of software shall not require power down of the system or loss of system fire protection while modifications are being made.

1.8.3 Certifications:

.1 Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.9 **WARRANTY**

1.9.1 All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one (1) year from the date of substantial performance. The full cost of maintenance, labour and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.10 **APPROVALS**

1.10.1 The system shall have proper listing and/or approval from the following nationally recognized agencies:

.1 ULC Underwriters Laboratories Canada.

1.10.2 The Fire Alarm Control Panel and all transponders shall meet the modular listing requirements of Underwriters Laboratories of Canada. Each subassembly, including all printed circuits, shall include the appropriate ULC modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts. Systems that do not include modular labels may require return to the factory for system upgrades, and are not acceptable.

2 PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

2.1.1 All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signalling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

2.1.2 All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

2.1.3 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRING

2.2.1 Conduit:

.1 Conduit shall be in accordance with Ontario Electrical safety Code (OESC) and all applicable bulletins.

.2 All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.

.3 Cables must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.

.4 Wiring for 24 volt control, alarm notification, emergency communication and similar power limited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

.5 Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

2.2.2 Wiring

.1 All fire alarm system wiring shall be new.

.2 Wiring shall be in accordance with local, provincial and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signalling line circuits, and 16 AWG (1.63 mm) for notification appliance circuits.

.3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system.

.4 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; A trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

2.2.3 Terminal Boxes, Junction Boxes and Cabinets:

.1 All boxes and cabinets shall be CSA listed for their intended purpose.

3 EXECUTION

3.1 INSTALLATION

3.1.1 Installation shall be in accordance with the CAN/ULC S-524 Installation of Fire Alarm standard, local and provincial codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

3.1.2 All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

3.1.3 Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:

.1 Factory trained and certified personnel.

.2 Canadian Fire Alarm Association Fire Alarm Certified personnel.

.3 Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

3.2.1 Furnish and install the devices as described herein and as shown on the plans. Include sufficient control unit(s), audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

3.2.2 Line Isolator: Install as per ULC S524.

3.2.3 End of Line Resistor (EOL): Do not install in ceilings or ceiling spaces. Locate at ceiling lines above a pull station location. Identify each EOL resistor with lamicoid nameplate indicating zone/circuit number. EOL to be located at same location on each in multiple floor building.

3.2.4 Provide all necessary contacts and relays required to complete the wiring.

3.2.5 Provide mounting square electrical box 4” x 4” (102mm), 2 1/8” (54mm) minimum depth or single gang electrical box 2 ½” (64mm) minimum depth with all devices (Isolators, Individual Addressable Module (IAM), End of Line (EOL).

3.3 WIRING INSTALLATION

3.3.1 Wiring Method: Install wiring in raceway according to Section 16100 “Electrical Basic Materials and Methods.”

3.3.2 Wire alarm signal appliances in accordance with requirements by manufacturer and operation. Install end of line device for signal circuit in suitable box adjacent to last signal of signal circuit. If circuit has only one device, end-of-line- device can be mounted in device.

3.3.3 Equip raceways with separate green ground-wire and connect to ground lug at each outlet box of device and connect ground wires directly to ground bus in control panel.

3.3.4 Conductors shall be solid copper. The minimum size of conductor shall be:

.1 16 AWG for individual conductors

.2 16 AWG for integral assembly of two or more conductor cables

.3 16 AWG for control and audible signal circuits. In no case shall the voltage drop exceed 10%. Increase wire size as required to maintain 10% voltage drop maximum in any line.

3.3.5 Provide, install and connect wiring and interconnecting wires and cables as specified herein, as required by control panel manufacturer and as indicated on Drawings.

3.3.6 System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the Canadian Electrical Code.

3.3.7 Contractor shall obtain from the Fire Alarm System Manufacturer written instructions regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

3.3.8 Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.3.9 Wiring within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3.10 Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

3.3.11 Color Coding: Color-code fire alarm red conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-

initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction and pull box covers red.

3.3.12 Identify fire alarm system conduits and cables with a 25mm red mark every 6000 mm, and at access locations.

3.3.13 Signal Circuits: Do not exceed 75% of circuit capacity

3.3.14 T-tapping of Class A circuits are NOT permitted.

3.3.15 T-tapping Class B circuits are permitted.

3.3.16 Install and connect wiring as follows:

.1 In conduit independent of all other wiring.

.2 Make wiring splices only in junction boxes using pressure type terminal blocks.

.3 Wire markers for wiring.

.4 Uniformly colour code initiating, signal and ancillary wiring using a different colour of wire for each.

.5 Identify terminal blocks.

.6 Terminate each wire under a separate terminal.

.7 Do not exceed wiring unbroken from one terminal to another.

.8 Transient suppression devices: all circuits.

.9 Surge/transient protection for wiring including shields that is connected to the FACP from the exterior.

3.4 IDENTIFICATION

3.4.1 Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."

3.4.2 Identify each horn with the panel number and circuit number. Attach identification to horn's junction box.

3.5 GROUNDING

3.5.1 Ground cable shields and equipment according to system manufacturer's instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common mode returns, noise pickup and other impairments.

3.5.2 Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

3.5.3 Ground equipment and conductor and cable shields. Measure, record, and report ground resistance.

3.5.4 A separate #12 AWG, RW90, grounding conductor in each conduit.

3.5.5 All wiring to be free of ground faults except those circuits that are intentionally grounded to detect ground faults.

3.6 **PROGRAMMING**

3.6.1 Enter system programme into erasable, programmable read only memory.

3.7 **TYPICAL OPERATION**

3.7.1 Actuation of any manual station, smoke detector heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

.1 Activate all programmed NAC circuits.

.2 Actuate all strobe units until the panel is reset.

.3 Release all door locks controlled by security panel at doors to adjacent zones on the floor from that the alarm was initiated.

3.8 **TESTING**

3.8.1 Provide the service of a competent, factory trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with CAN/ULC S537.

3.8.2 Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

3.8.3 Open initiating device circuits and verify that the trouble signal actuates.

3.8.4 Open detection circuits and verify that the trouble signal actuates.

3.8.5 Open and short notification appliance circuits and verify that trouble signal actuates.

3.8.6 Ground initiating device circuits and verify response of trouble signals.

3.8.7 Ground detection circuits and verify response of trouble signals.

3.8.8 Ground notification appliance circuits and verify response of trouble signals.

3.8.9 Check presence and audibility of tone at all alarm notification devices.

3.8.10 Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.

3.8.11 Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

3.8.12 When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by grouped devices, sensitivity monitoring, verification functionality and similar.

3.9 **FIELD QUALITY CONTROL**

3.9.1 Manufacturer's Field Service: Provide services of a factory-authorized and CFAA certified service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system. Engage

manufacturer's field representative to perform verifications as specified and in accordance with CAN/ULC-S537.

3.9.2 During period of pretesting, testing, adjustment of system and verification, Contractor must make available qualified electricians.

3.9.3 Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

3.9.4 Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

3.9.5 Final Verification Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance verification.

3.9.6 Minimum System Verification: Verify the system according to the procedures outlined in ULC S537.

3.9.7 Verify the absence of unwanted voltages between circuit conductors and ground.

3.9.8 Test all conductors for short circuits using an insulation-testing device.

3.9.9 With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.

3.9.10 Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.

3.9.11 Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened for not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

3.9.12 Test each initiating and indicating device for alarm operation and proper response at the control unit.

3.9.13 Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, and quality, freedom from noise and distortion, and proper volume level.

3.9.14 Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

3.9.15 Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.9.16 Report of Tests, Verification and Inspections: Provide a written record of inspections, tests, verification and detailed verification results in the form of a verification log. Submit log upon the satisfactory completion of tests and verification.

3.9.17 Note: Open flame is not to be used for testing.

3.9.18 Arrange for personnel of Authorities Having Jurisdiction to be present for the verification of the system.

3.9.19 Contractor shall be responsible to ensure that the governing parties have accepted a complete functional fire alarm system.

3.9.20 On completion of testing, submit a report to (Owner) (and) (Consultant) detailing testing and verification performed on system including, but not limited to, the following information:

3.9.21 Full name and address of facility at which system is installed.

3.9.22 Full name and address of organization or company performing testing.

3.9.23 Full name and address of contractor or subcontractor who installed system.

3.9.24 Date of report.

3.9.25 A statement and certification of verification confirming that fire alarm and voice communication system was left in a completely operable condition and that system was installed and operates in complete accordance with contract documents.

3.9.26 A complete list of equipment installed.

3.9.27 Results of tests.

3.9.28 Serial numbers, location, zone and type of each detector.

3.9.29 Sensitivity settings for each detector, as measured or set, with ventilation system in operation.

3.9.30 A list of faults found, if any, and corrective action taken for each.

3.9.31 The testing technician's full name and signature.

3.9.32 Contractor shall provide a dB test report to the Owner and Consultant for consideration after the system is installed and two (2) weeks prior to the fire inspection.

3.9.33 Proof of liability insurance for the pretesting, testing and verification.

3.9.34 The fire alarm system shall be tested and verified in accordance with the latest revisions of CAN/ULC-S536 (Standard for Inspection and Testing of Fire Alarm Systems) and CAN/ULC-S537 (Standard for the Verification of Fire Alarm Systems).

3.9.35 Perform any changes necessary as a result of the above items in accordance with the system manufacturer’s direction.

3.9.36 Fire alarm manufacturer to supply to electrical contractor reasonable amounts of technical assistance with respect to any changes necessary to execute work required by this section. During period of inspection by manufacturer, electrical contractor shall make available, to manufacturer, electricians as designated by manufacturer.

3.9.37 Inspect and check each individual device in entire system for proper connection, supervision and function in accordance with CAN/ULC-S536 and CAN/ULC-S537. Identify detectors, and signal appliances not installed within requirements of CAN/ULC-S524, in remarks column of verification report and bring to The Owner's attention prior to their acceptance test.

3.9.38 Any software changes done, subsequent to verification of any portion of the system, shall require;

.1 Verification via "software utility" that no other portions of the software were affected. A printout of this report is to be incorporated as part of the verification documents. Or

.2 Re-verification of all system components verified at the time of the change.

3.9.39 Arrange for testing and verification by fire alarm system manufacturer or its representative firm and pay all fees and charges for the service. Obtain verification certificate and verification report showing each device checked, and that work has been carried out. Use verification forms similar to Canadian Fire Alarm Association (C.F.A.A.) forms.

3.9.40 Verify fire alarm system in accordance with the requirements of CAN/ULC-S537.

3.9.41 Verify only when entire system is fully operational and no subsequent work will be performed on system.

3.9.42 If such subsequent work is required, entire verification must be repeated.

3.9.43 Issue certificate of verification only after completion of deficiencies noted during verification have been corrected and re-verified.

3.9.44 On completion of the verification testing, obtain from the system manufacturer and forward to the Owner and Consultant a verification certificate complete with a detailed verification report listing each and every system component, its location in the building and its acceptability. It is intended that the third party verification shall complete its duties concurrently with the Vendor verification team. Include all fire alarm verification certificates in the Owner's manuals, binders and digital copies.

3.9.45 Ensure that all costs for the above testing, verification and certification are included in the bid price.

3.10 **FINAL COMMISSIONING**

3.10.1 After completion of work, make arrangements with the Owner, manufacturer of control equipment and other installers of related and connected equipment to conduct final functional acceptance test.

3.10.2 Tests:

.1 Spot check of devices to ensure proper connections and supervision.

.2 Operation of alarm initiating device on each detection circuit to verify required operation of alarm devices, annunciator and other installations.

.3 Testing of signal devices for correct operation and function.

3.11 INSTRUCTION

3.11.1 Provide instruction as required for operating the system. Hands on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

3.11.2 Instruct and demonstrate operation of manual pull station covers and that the covers themselves do not activate the fire alarm system alarm condition.

3.11.3 The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.11.4 Provide in the operations and maintenance manuals sequences of operation, maintenance instructions, the final set of shop drawings, device list, as-built wiring diagrams and plans showing the as-built wiring run configurations.

3.12 CLEANING AND ADJUSTING

3.12.1 Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

3.12.2 Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.13 FINAL INSPECTION

3.13.1 At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.13.2 Contractor to coordinate for the inspection and provide the consultant and Client with a copy of final inspection report.

3.14 ON-SITE ASSISTANCE

3.14.1 Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to 3 requested adjustment visits to the site for this purpose.

END OF SECTION