



Electrical Specifications

**Trillium Lakelands District School Board
1271 Cedar Lane, Bracebridge, ON P1L 1N4**

**TLDSB - Bracebridge SS - Domestic Booster Pump Replac. - EP
06226**

**Issued for Permit / Tender
Friday, March 27, 2026
Rev. #: 1.01**

Prepared By



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Section 26 01 00 - Electrical General Requirements

PART 1. GENERAL

1.1 Related Instructions (26 01 00)

- .1 Division 1, General Requirements is part of this Section and shall apply as if repeated here.
- .2 Unless specified otherwise, this Section shall apply to all Sections of the Electrical Division.
- .3 Conform to the conditions stated in the Contract Form and Supplementary Conditions.
- .4 This section of the specification is an integral part of the contract documents and shall be read accordingly.

1.2 Intent (26 01 00)

- .1 Mention herein or indication on drawings of articles, materials, operations or methods requires supply of each item mentioned or indicated, of quality, or subject to qualifications noted; installation according to the conditions stated and; performance of each operation prescribed with furnishing of necessary skilled labour, equipment, tools, instruments, services and incidentals for Electrical Work, Electrical Division.
- .2 Sections of these Electrical Specifications are not intended to delegate functions nor to delegate work and supply to any specific trade and the work shall include all labour, materials, equipment, tools and inspection required for a complete and working installation as described.

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- .3 The Specifications are integral with the Drawings which accompany them. Neither is to be used alone. Any item or subject omitted from one, but included in the other is properly specified.
- .4 Wherever differences occur in the Contract Documents, the maximum conditions will govern and be allowed for in the Tender price. The item to be incorporated will be at the option of the Consultant.

1.3 Definitions And Abbreviations (26 01 00)

.1 Definitions

Where used, words "Section" and "Division" shall also include other Subcontractors engaged on site to perform work to make the building and site complete in all respects.

Where used, the word "products" shall mean the material, equipment, component, machinery, or fixtures forming the completed work.

Where used, word "connect" shall mean to supply and install all wiring and raceways and make all power connections to products.

Where used, word "supply" shall mean to include all labour, materials and services to furnish to site in location required or directed complete with accessory parts, but is not intended to include installation.

Where used, word "install" shall mean to include all labour, materials and services to secure in place products, including receiving, unloading, transporting, storage, uncrating, installing, connecting and performance of such testing and finish work as is compatible with degree of installation specified complete ready for use.

Where used, words "contractor" and "installer" shall mean the same entity responsible for the installation works.

Where used, word "provide" shall mean to supply and install as each is described above.

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Where used, word "commission" shall mean to startup and initial operation of products as required to demonstrate satisfactory operation of products and the entire system including calibration of any instrumentation.

Where used, word "work" shall mean the total construction required by the Contract Documents and includes all labour, products and services.

Where used, wordings such as "approved, to approval, as directed, permitted, permission, accepted, acceptance, report to", shall mean "approved, directed, permitted, accepted, report to", by the Consultant.

.2 Abbreviations

AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
AIC	Ampere Interrupting Capacity
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
CUA	Underwriters Association (CUA)
EEMAC	Electrical and Electronic Manufacturers Association of Canada
ESA	Electrical Safety Authority (ESA) Requirements Canadian
FAT	Factory Acceptance Test
GFP	Ground Fault Protection
IFC	Issued for Construction
LOTO	Lock Out Tag Out
LV	Low Voltage

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MV	Medium Voltage
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OBC	Ontario Building Code (OBC)
OESC	Standards Ontario Electrical Safety Code (OESC)
ULC	Laboratories of Canada (ULC)
SLA	Service Level Agreement

1.4 By-Laws and Regulations (26 01 00)

- .1 The Contractor shall conform to latest Government, Provincial and Municipal By-laws, regulations, Codes and Standards, ESA requirements and requirements of other authorities having jurisdiction in the area where work is to be performed.
- .2 Minor changes required by any AHJ shall be carried out without change to the Contract amount.
- .3 Standards established by drawings and specifications shall not be reduced by applicable codes or regulations.

1.5 Site Conditions (26 01 00)

- .1 Examine the site and local conditions.
- .2 Examine carefully all Drawings and complete Specifications to ensure that work and equipment will satisfy conditions and performance requirements as shown.
- .3 Maintain a complete set of Contract Documents at all times for field reference by the Consultant.

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.4 Examine the work of other Contractors and report at once any defect or interference affecting the work, its completion or warranty.

.5 No allowance will be made for any expense incurred through failure to make these examinations or to report any such discrepancies and omissions in writing, five (5) working days prior to tender closing.

.6 Submission of a Tender confirms that the Contract Documents and site conditions are completely understood and accepted without qualifications unless exceptions are specifically noted in the Tender.

1.6 Pricing Instructions (26 01 00)

.1 Tenders and Forms

.1 State separate prices in the Tender Form for work indicated. Prices shall include the complete cost of the work, i.e. all equipment, wiring, material, labour, incidentals, profit, overhead, etc, excluding taxes. It shall be the Owner's option to delete from the Contract any of the work indicated at the prices stated.

.2 Cash allowances shall be carried in the Contract for the work indicated, including all equipment, wiring, material, labour, incidentals, profit, overhead, etc, excluding taxes. If the actual cost is less than the Cash Allowance, the remainder shall be reverted to the owner. If the actual cost exceeds the Cash Allowances, the owner will reimburse the extra amount.

.3 All Contract drawings are to be read as a complete set. Any item or subject not indicated on a drawing sheet, but included on the other sheet within the drawing set shall be deemed properly specified and included in the contract.

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.4 Should there be a conflict or inconsistency within the drawings, the contractor shall notify the engineer in a timely manner within the tender period. No cost variation shall be entertained for instances raised post tender.

.5 Wherever differences occur in the Contract drawings, the maximum conditions will govern and be allowed for in the Tender price.

.6 Contract Breakdown

.1 Submit a breakdown of the contract price into classifications to the satisfaction of the Engineer with an aggregate of the breakdown totaling the contract amount. This breakdown will be used in computing progress payments. Progress claims, when submitted, are to be itemized against each item of the contract breakdown generally to be listed below:

Secondary service.

Main Distribution Centre.

Motor control and associated mechanical wiring.

Panelboards.

Panel feeders.

Branch wiring (lighting).

Branch wiring (power).

Lighting - building.

Lighting - site.

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Grounding.

Fire alarm system.

Telephone/wireless system.

Cable T.V. System.

Access Control.

Generator Distribution.

Emergency call and asset tracking and emergency power.

.2 Alterations

.1 Alterations entailing additional work or deletions shall be carried out only upon the written request of the Engineer. Additional work or deletions shall be settled in the manner described in the General Conditions.

.2 Unless otherwise specifically requested, uniformity of manufacture shall be maintained for any particular item or type of equipment throughout the building.

.3 Any prices submitted for additional work or alterations shall include a price breakdown for all labour and material and where required, shall be justified by invoices, time sheets, etc. No extras will be allowed without prior written authorization from the Engineer.

.4 Valuation of Changes

.5 For each change submit a complete itemized breakdown of labour and material.

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.6 Only the net difference between an extra and a credit will be subject to overhead and profit mark-up.

.7 Material shall be valued at current trade prices incorporating all discounts and labour rates. Overhead and profit shall be as shown in the Tender Form.

1.7 Security for the Works (26 01 00)

.1 The Contractor, responsible for this Division, shall be responsible for the full protection, insurances and guarding of the works pertaining to this Division, until Substantial Completion.

.2 No claim will be entertained for any events arising from damage, theft or vandalism of material whether installed or stored on site.

1.8 Standards of Material and Workmanship (26 01 00)

.1 All electrical equipment, products, material and systems as specified and shown on the drawings shall be supplied new and conform to the latest standards of the Canadian Standards Association. Any equipment or material specified by technical description only, shall be to the best commercial quality obtainable and fit for purpose.

.2 All work to be executed in a neat and workmanlike manner performed by qualified Tradesmen.

.3 The work throughout shall be executed to the highest standards and to the entire satisfaction of the Engineer who shall interpret the meaning of the Contract Document and shall have the authority to reject any work and materials, which, in his judgment, is not in full accordance therewith. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

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- .4 The Contractor shall warrant that the materials and workmanship shall be of the highest quality, that the equipment shall be installed in a practicable and industrious manner with due skill and appropriate physical resources in a proper workmanlike and careful manner in accordance with best recognized good practice.
 - .5 It is specifically intended that all material or labour which is usually provided as part of such equipment, as is called for, and which is necessary for its proper completion and operation shall be provided without additional cost whether or not shown or described in the Contract Document.
 - .6 The Contractor shall be thoroughly acquainted with the work involved and shall verify on site all measurements necessary for proper installation work. The Contractor shall also be prepared to promptly furnish any information relating to the work as may be necessary for the proper installation of work and shall cooperate with and coordinate the work of others as may be applicable.
 - .7 All components and their respective adjustment, which do not form part of the equipment installation work, but influence the optimum and safe operation of the equipment shall be considered to form part of, and shall be included in the Contractor's scope of works.
 - .8 All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.
 - .9 The Contractor shall make sure that all safety regulations and measures are applied and enforced during the installation and guarantee periods to ensure the safety of the public and that of the end user.
 - .10 The Contractor shall provide everything necessary for the proper execution of the works, using materials and workmanship of the quality and standards as specified herein, provided that such quality and standards shall be to the reasonable satisfaction of the Engineer.
- 1.9 Permits, Certificates and Fees (26 01 00)
- .1 The Contractor shall apply for, obtain, and pay for any and all permits, licenses, certificates, connection charges and inspections as required by authorities having

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- jurisdiction applicable to this Division. Including any premiums applicable due to requirements for after office hours inspections.
- .2 The first submission of plans and specifications to ESA will be made by the Consultant. From then on, the Contractor shall be responsible for obtaining and complying with all the requirements of ESA.
 - .3 Submit all required documentation to the authorities for their approval and comments before starting any Work. Provide all additional drawings, details or information as may be required. Comply with any changes requested by authorities as part of the contract, but notify the consultant immediately of such changes.
- 1.10 Drawings (26 01 00)
- .1 Drawings and specifications are complementary; what is called for by one shall be binding as if called for by both.
 - .2 Should any discrepancies occur between drawings and specifications which leaves doubt as to the true intent and meaning of the drawings and specifications, obtain a ruling from the Engineer before submitting tender. If this is not done, it will be assumed that the more expensive alternative has been allowed for.
 - .3 The Contractor may obtain additional Drawings from the Engineer after submitting a written request and paying a handling charge of \$75.00 + applicable provincial tax per drawing.
- .4 Contract Drawings
- .1 Only drawings issued for IFC shall be used for construction purposes.
 - .2 The Contract Drawings of this Division are performance drawings and indicate the scope and general arrangement of the Work. The Drawings are diagrammatic except where specific details are given.

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- .3 The Drawings shall be read in conjunction with Architectural, Structural, Mechanical and all other Division Drawings applicable to the Contract.
- .4 Any changes required to accommodate structural conditions, (beams, columns caps, etc.) shall obtain Consultant's approval before proceeding.
- .5 Interference Drawings
- .1 Prior to starting any work the Contractor shall prepare Interference Drawings in conjunction with all parties and trades concerned. Interference drawings shall show all sleeves, openings, passage of piping, Cable Tray and conduits through building structure. Drawings shall also show inserts, curbs, equipment bases, anchors, special hangers and weights on all load points.
- .2 Prepare fully dimensioned detail drawings of products and services in electrical rooms, service and ceiling spaces, and all other critical locations. Coordinate the Work with all other Divisions. Base drawings on reviewed shop drawings and indicate all details pertaining to access, clearances, sleeves, electrical connections, and elevations of pipes, ducts and conduits. Include location of access doors provided under this Division.
- .3 Ensure that clearances required by jurisdictional authorities are indicated on the Interference Drawings.

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.6 Shop Drawings

.1 The Contractor shall assume full responsibility for the preparation and submission of shop drawings of all Products in accordance with Division 1-General requirements as specified herein and in each section of Electrical Division.

.2 All Shop drawings shall have a minimum 210 mm x 285 mm (8-1/2" x 11") clear space on the front sheet, suitable for stamping. The cover sheet shall include the project name, Electrical Division Section # name, product description and product tag. Where multiple equipment is submitted under one binding, include an index of all equipment as the front sheet.

.3 The Contractor to allow a minimum of two (2) weeks for Consultant's review. The Contractors Project Schedule (Gantt Chart) to reflect the review timelines.

.4 The Consultant will only review shop drawings after the Contractors internal review being correct and stamped by trade purchasing item, before being submitted. which bears the Contractor's and/or Architect's stamps of approval.

Submit shop drawings showing the following:

Project name and applicable specifications section.

Product tag number.

Manufacturer's name and model number.

Supplier's name.

Approval agencies.

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Shipping and working weight.

Performance characteristics.

Dimensions, including required clearances.

Electrical characteristics.

Bill of materials and finishes.

Time required to fabricate and deliver.

All variations from Tender Documents as approved during tender process.

Construction and field connection details.

Installation requirements.

.5 The Consultant's review shall not relieve this Division of responsibility Contractor's to provide Products in accordance with the design intent and Contract Documents.

.6 Where permitted by the Construction Manager, shop drawings may be submitted in PDF in accordance with the above-noted requirements.

.7 Record Drawings

.1 From the start of the Contract Work the Contractor shall meticulously maintain at least two (2) sets of documents for Record Purposes, and regularly mark up all relevant record information, changes, deviations and record of material on these dedicated sets of drawings.

.2 Drawings shall indicate positions of all cables, cable joints, cable markers, cable ducts, distribution panels and switchboards, Luminaire positions, Receptacle Positions, Isolator positions, cable trays, etc. shall be given, as measured from fixed

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reference points such as kerbs, survey pegs, building grid lines, etc. Record drawings shall reflect the actual lengths of all feeder cables.

.3 Record Drawings to be submitted in Drawings to be size format the same as Contract Drawings.

1.11 Mock-ups and Trial Usage (26 01 00)

- .1 Provide mock-ups in accordance with the conditions stated in the Contract Form and Division 1 of the Specifications and/or as requested by Owner and Architect.
- .2 Trial usage of any equipment or materials shall not be construed as evidence of acceptance of same and no claim for damage shall be made for injury to or breaking of any part of such work which may be so used.

1.12 Setting out the Works (26 01 00)

- .1 Thoroughly examine the drawings and specifications and especially check figure dimensions immediately after awarding of contract. Report any discrepancies and errors or omissions to the Engineer. Figures, full size and detail drawings shall take precedence over scale measurements of drawings. No pleas as to the action or direction of the Engineer will be submitted in justification of any errors in construction where departure is made from the drawings, specifications or contract.
- .2 Upon award of contract and within one month, complete the project start-up forms at the end of this section of the specification. The engineer must receive this completed form prior to the approval of the first progress claim.
- .3 All work completed contrary to the intent of the drawings and specifications shall be corrected. Where the intent of the drawings and specifications is not clear, obtain clarifications from the Engineer before proceeding with the work.
- .4 In setting out the work, make reference to electrical, mechanical, structural, architectural and specialty drawings. Consult with respective trades in setting out of location of conduit runs, lighting fixtures, panel assemblies, etc. so that conflicts are avoided and symmetrical even spacing is maintained.

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- .5 Conduit shall be laid out to avoid interference with other trades and to maintain maximum headroom. In the ceiling space, conduit shall be arranged to conserve space, to be serviceable and to avoid crossovers.
- .6 Where outlets occur in exterior walls, ensure that there is insulation behind the outlet box to prevent condensation in the box.
- .7 Where outlets are installed within walls with fire ratings, the fire rating must be maintained and fire resistant putty pads used.
- .8 The contractor shall allow for variation of 3m from location shown on drawings for all electrical outlets without any extra cost.
- .9 No structural member shall be cut without the knowledge and consent of the Engineer. Be responsible for any damage caused by other trades by improper location or carrying out of the work.

1.13 Inspections, Testing and Commissioning (26 01 00)

.1 Inspections

.1 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work furnish final unconditional certificates of approval by the inspection authorities.

.2 Application for final review will be considered when the Work has been completed and written declarations submitted that all commissioning, testing adjustment, set up and documentation is complete. Final review shall be done when:

All reported deficiencies have been corrected.

All systems have been balanced, tested, commissioned and are operational.

The Owner has been instructed in the operation and maintenance of all equipment.

All reports have been submitted and reviewed.

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All maintenance manuals have been submitted and reviewed.

All tags and nameplates are in place and all data submitted and reviewed.

Cleaning up is finished in all respects.

All certificates are furnished.

All spare parts and replacement parts specified have been provided.

All record drawings have been submitted and reviewed.

.3 Factory Acceptance Tests

.1 Prior to leaving the place of manufacture the following items shall require a FAT.

Generator (Diesel or Gas) Sets.

Custom made Distribution Boards.

Any MV Switchgear.

PLC boards.

Motor Control Centers.

.2 The Contractor shall make all necessary arrangements for any required dummy loads and ensure that there is sufficient fuel, if applicable, for the abovementioned tests.

.3 Where a FAT is called for, the cost for FAT inspections / tests shall be for the Contractors account including for all the necessary flights, accommodation, car rental / transportation etc complete for the following minimum personnel, Owner,

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Owner's representative, Engineer, Engineers Representative and Contractors personnel.

.4 Any failure of the operational tests shall require a retest of the units at the contractors expense.

.5 Testing

.1 Carry out all tests specified and tests required by authorities having jurisdiction. The testing and adjusting is the responsibility of this Division.

.2 Provide all equipment, labour, instruments, expenses of the manufacturer's representative, and incidentals, and pay for all power and fuel required to carry out the tests.

.3 Submit the record of all tests and have these tests signed by the Contractor's Superintendent and, where applicable, the manufacturer's representative. Show in schedule form a record of the systems or parts of systems tested, the date of the test, the circumstances such as current, temperatures, etc., the duration of the test and any special remarks pertaining to events during the test. Note which tests have been witnessed by authorities having jurisdiction.

.4 Submit certification letters from the manufacturers of all equipment certifying that their technical representatives have inspected and tested their equipment and are satisfied with the methods of installation and operation. Where existing systems are extended, provide letters covering both new and existing equipment and connections. These letters shall state the names of persons present at testing,

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methods used and a list of functions performed with location and room numbers where applicable.

.5 Conduct the following tests, but not limited to:

Fire alarm system test.

Emergency lighting system test.

Power distribution, including control and switching, polarity tests, voltage-drop tests and phase balancing measurement.

General operations: energize and operate electrical circuits and items.

Circuits originating from branch distribution panels.

Lighting and lighting control.

Motors, heaters and associated control equipment, including sequenced operation.

Di-electric tests, hi-pot tests, insulation resistance tests and ground continuity tests as required by nature of various systems and equipment.

Demonstrate systems operation.

.6 Repair, alter, replace, test and adjust as necessary for a complete and operating electrical System.

.6 Commissioning

.1 The Contractor shall be responsible for commissioning of all work provided under this Division including for the provision of all instrumentation, load banks (if applicable) test equipment etc.

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.2 Commissioning shall commence with activation and verification of all systems in accordance with the requirements of the Specifications. This will include but not be limited to the following items to be tested, adjusted and verified:

Complete activation of all systems.

Re-torquing of all bolted connections in all distribution equipment.

Calibration, testing and verification of all systems.

Secondary switchboard.

Transformers.

Generator operation and load transfer.

Refueling operations of the Generator, if applicable.

Lighting and power distribution.

Fire alarm systems.

Emergency lighting system.

Electric heating equipment/system.

Other Systems: CCTV, Intercom, Security, Lighting Controls, etc.

Demonstrate full operation of all integrated systems as defined in the specification.

1.14 Demonstration and Instruction (26 01 00)

.1 Provide personnel, equipment and tools to demonstrate and instruct Owner's designated personnel in operation, controlling, adjusting, trouble-shooting and servicing of all systems and equipment to the satisfaction of the Owner. This work shall take place during the Owner's regular business hours prior to acceptance.

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.2 Where specified elsewhere in this Division, manufacturers shall provide demonstration and instructions.

.3 Where deemed necessary, the Consultant or Owner's agent may record these demonstrations via video tape or other means for future reference.

1.15 Early Occupation (26 01 00)

.1 The Owner might occupy portions of the building before the work is complete. Sufficient advance notice will be given to allow scheduling of the electrical work to meet the Owner's requirements.

.2 Set construction priorities to satisfy the Owner's requirements. Schedule the Work of this Division so that:

Relevant equipment is ready for operation as defined in these Specifications.

Life safety system is tested and accepted by the Authority having jurisdiction.

Emergency power system is tested and accepted by the Authority having jurisdiction.

The Owner will take over individual items of equipment used for early occupancy and the warranty period will start when conditions of start-up have been complied with.

Early occupancy and the Owner's takeover of individual items of equipment does not relieve Electrical Division of its responsibility to test, adjust, balance, commission and demonstrate the systems in accordance with the Contract Documents.

1.16 Waste Management (26 01 00)

.1 Separate and recycle waste materials.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with General Contractor's requirements.

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- .3 Divert unused wiring and metal materials to metal recycling facility, or place in appropriate on-site bins for recycling in accordance with General Contractor's requirements.

1.17 Protection and Cleaning (26 01 00)

- .1 Securely plug or cap open ends of electrical raceways or equipment to prevent entry of dirt, dust, debris, water, snow or ice.
- .2 Equipment stored on site shall be protected from weather and kept dry and clean at all times. Take care to avoid corrosion of metal parts.
- .3 Protect all finished and unfinished Work of this and other Divisions from damage due to carrying out this Work.
- .4 Make good any damage caused directly or indirectly to walls, floors, ceilings, woodwork, brickwork, finishes, etc.
- .5 Before energizing any systems, inspect and clean the inside of all panelboards, switchgear and cabinets to ensure that they are completely free from dust and debris.
- .6 Clean all polished, painted and plated work. Clean all lighting fixtures. Remove all debris, surplus material and tools.
- .7 Carry out additional cleaning operations of systems as specified in other Sections of this Division and as Division 1 requirements.

1.18 Site Store and Offices (26 01 00)

- .1 Should it be deemed necessary for a Site Store then the following shall apply.

- .1 Site Store

- .1 The Contractor shall be responsible for ensuring that:

Storage area is suitably demarcated with respect to material types.

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Mesh security fence is 2.4m high with rolled razor wire fixed to the top. Gates shall be positioned in such a way that delivery vehicles can pass through without having to turn around.

Access is controlled 24 h a day.

Issued and receipt of material is controlled by an appointed person.

Risks items such as copper are secured preferably under lock and key. This includes copper scrap. Smaller items such as nuts, bolts, clamps, lugs, etc.

Loss of material shall be immediately reported to the Engineer.

Adequate under cover storage must be made available for items that can be damaged by rain or snow.

- .2 The Contractor shall supply and maintain adequate and suitable sheds for the storage of materials. Sheds for the storage of materials that may deteriorate or corrode if exposed to the weather shall be weatherproof, adequately ventilated and provided with raised floors.
- .3 Latrine and ablution facilities and first-aid services shall comply with the regulations of the local authority concerned and shall be maintained in a clean and sanitary condition.
- .4 On completion of the Works or as soon as the facilities provided by the Contractor are no longer required, the Contractor shall remove such facilities and clear away all surface indications of their presence
- .5 Site Offices
 - .1 The Contractor shall provide and furnish one or more offices (as scheduled) for the use of the Engineer. Each office shall consist of one room with a floor area of at least 12m² and a ceiling height of at least 2.5m.

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- .2 Each office shall be weatherproof, shall have a wooden boarded floor that is at least 150mm above the ground, and shall be provided with a ceiling and a lining to the walls, or equivalent insulation, with an acceptable type of door with a secure lock, and two opening windows of glazed area at least 3m².
- .3 Each office shall be well ventilated and shall be so insulated as to provide comfortable working conditions. The internal furnishings of each office shall include:
- one trestle table, 2m long x 1m wide x 0,9m high, with a smooth top;
 - one table or desk having a top of size at least 1,5m x 0.9m and at least one lockable drawer;
 - one high stool;
 - two chairs;
 - a lockable upright steel cabinet with three shelves or a steel filing cabinet with four drawers;
 - shelving of total length 3m and of nominal width 300mm;
 - an acceptable blind on each window;
 - a wash-hand basin;
 - acceptable lighting;
 - and HVAC for heating in winter and cooling in summer.
- .6 The Contractor shall also supply a toilet for the exclusive use of the Engineer. On completion of the Works, ownership of the buildings and their furnishings shall revert to the Contractor who shall remove them from the Site.

Part 2. PRODUCTS

|

ELECTRICAL SPECIFICATION

Section 26 01 00

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**Operation and Maintenance of Electrical
Systems**

Part 3. EXECUTION

Not Used

END OF SECTION

ELECTRICAL SPECIFICATION

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Section 26 01 26

Maintenance Testing of Electrical Systems

SECTION 26 01 26 - MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1 American National Standards Association (ANSI)

.1 ANSI S1.4-1983 Sound Level Metres (R2001)

.2 ANSI S1.11-2004 Octave-Band and Fractional Octave-Band Analog and (R2009)
Digital Filters

1.2 Canadian Standards Association (CSA)

.1 CSA C22.2 No 0.4-04 Bonding of Electrical Equipment

1.3 Related Sections

.1 Read this Section in conjunction with related electrical starting and testing Sections.

PART 2. PRODUCTS

|

Not Used

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Section 26 01 26

Maintenance Testing of Electrical Systems

PART 3. EXECUTION

3.1 BASIC ELECTRICAL START-UP AND TESTING

.1 Energising Main Electrical System:

Prior to energising main electrical system:

Verify supply authority voltage and phase rotation.

Ensure all testing as specified in Section 26 08 30 has been completed and deficiencies have been corrected.

Megger all feeders and record results on approved test report forms.

.2 Testing of Wiring and Wiring Devices:

Test conductors at distribution centres and panelboards for insulation resistance to ground (megger test).

Test service grounding conductors for ground resistance.

Test all wiring devices for correct operation and circuitry.

.3 Ground Resistance Testing:

Measure ground resistance of ground grids with earth test megger to verify compliance with CSA C22.2 No. 0.4 and Canadian Electrical Code.

.4 Load Balance Testing:

Perform load tests with as many building loads on as possible prior to Interim Acceptance and three months after Practical Completion.

Test load balance on all feeders at distribution centres, motor control centres and lighting panelboards.

If load unbalance exceeds 15%, reconnect circuits to balance loads. Revise panelboard directories and wiring identification accordingly.

.5 Power Factor Testing:

Record power factor readings at 15 minute intervals for full 72 hour period during a normal work week, once during summer with chiller operating and once during winter.

Take readings at the following locations on power distribution system:

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Maintenance Testing of Electrical Systems

Main Breaker.
All motor control centres.
Feeder breakers which control large motor loads.
Emergency generator.

.6 Voltage Testing and Adjusting:

Test voltage at service entry point, and motor control centres. Record voltages at Interim Acceptance and three months after Practical Completion for a period of ten hours (07:00 to 17:00) during a normal work day. Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions.

.7 Starting Motors:

Prior to starting motors:
Confirm motor nameplate data with motor starter heater overloads, setting of MCP's and sizing of fuses.
Verify rotation.
Ensure disconnects are installed.
Confirm labelling of motors, disconnects and starters.
Measure and record operating load amp readings for all three phase motors.

3.2 Motor Control Centres

- .1 Ensure all starters are properly labelled prior to testing.
- .2 Ensure all testing as specified in Section 26 08 30 has been completed.

3.3 Elevator Service

- .1 Prior to energising feeders for elevator equipment, megger feeders and record results. Confirm size of disconnects and fuses with elevator equipment suppliers.
- .2 Coordinate energising elevator feeders with elevator equipment supplier. Confirm interconnections to Fire Alarm System prior to Fire Alarm Verification.

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Section 26 01 26

Maintenance Testing of Electrical Systems

3.4 Lighting

- .1 Function test all light switches, luminaires, dimmers and lighting control equipment such as photo-cells and time clock settings.
- .2 Prior to energizing dimming system, ensure manufacturer has checked all equipment and wiring for proper installation and termination. Manufacturer to check that all pre-set levels are set and operate as specified.
- .3 Check operation of all battery operated emergency lighting units, exit lights and connection of exit lights to emergency lighting units as specified.
- .4 Record all photo-cell and time-clock settings.

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Maintenance Testing of Electrical Systems

3.5 Uninterruptible Power Supply (UPS) System if Applicable

Prior to energizing and testing of UPS System:

Tighten all cable terminations.

Check all alarm and shutdown circuits

Check operation of battery charger.

Ensure batteries are fully charged prior to testing.

Manufacturer to function test system as follows

Review installation of the equipment

Function test equipment with artificial load at rated system load, as follows:

Perform load test with full rated load for time duration specified for system. Simulate loss of normal AC source so that load is supplied by battery via inverter. Record following at ten equal time intervals:

AC Amp

AC Voltage

Frequency

Check load interruption on return of normal source.

Recharging of battery on return of normal source.

Check take-up of load under automatic bypass conditions.

Test all alarm and shutdown circuits by simulating conditions. Closing or opening of appropriate sensor contacts mechanically is not acceptable.

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Maintenance Testing of Electrical Systems

Test operation of maintenance bypass switch.

3.6 Standby Power Generation System

.1 Factory Testing:

Perform torsional analysis test of engine and generator compatibility.
Notify the Owner ten days prior to testing to arrange for witness testing.

- .2 Perform a five hour load test using a portable test bank. Perform test for four hours with load applied in 20% steps every 30 minutes until full load is applied and one hour at 110% full load. Record following at 15 minute intervals during the entire test:

Kilowatts
Amperes
Voltage
Frequency
Oil Pressure
Coolant Temperature

- .3 Test response of governor (droop of isochronous) applying 20% load and 100% load in one step. Use a storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test.
- .4 Test voltage regulator and compare for conformance to manufacturer's product data.

Record noise level measurements in dB at various locations around unit and area surrounding exhaust port.

- .5 Submit certified tests results for approval.

.6 Starting Standby Power Generation System:

Ensure generating system is disconnected from normal power supply.
Ensure all auxiliary support devices are operational, including ventilation and exhaust systems.
Ensure that engine has proper lubricant levels, coolant levels and fuel supply.

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Maintenance Testing of Electrical Systems

Ensure all testing on emergency distribution equipment and transfer switch as specified has been completed.

.7 Site Testing:

Conduct site Testing in conjunction with manufacturer.

.8 Simulate power failure including operation of:

Transfer switch.

Automatic starting cycle.

Automatic shutdown and return to normal.

Test all alarm and shutdown circuits by simulating conditions. Closing or opening of appropriate sensor contacts mechanically is not acceptable.

Record noise level measurements in dB at various locations in generator room and area surrounding exhaust port.

.9 Perform four hour load testing utilising as many of building loads as possible. Record following at 15 minute intervals during entire test:

Kilowatts

Amperes

Voltage

Frequency

Oil Pressure

Coolant Temperature

Room Temperature

3.7 Fire Safety Systems

.1 Prior to requesting verification of Fire Alarm system by Contractor, Verification Agent, and Fire Safety system manufacturer's technical staff shall:

Inspect system in conjunction with the Manufacturer to ensure that Fire Alarm system is correctly installed, connected and fully operational in accordance with requirements of the Contract Documents and Manufacturers recommendations. This includes all auxiliary equipment connected to fire alarm system such as elevators, central station tie-in, fan shut-down, sprinklers, door hold-open devices, etc.

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Maintenance Testing of Electrical Systems

Ensure that any subsequent work remaining to be performed on the above-noted items will not invalidate examinations and test performed during verification procedure.

Ensure that operation and maintenance data has been submitted.

Ensure that spare parts and maintenance materials have been delivered.

- .2 Certify to the Owner in writing that above prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed or corrected, prior to proceeding with verification.
 - .3 The Owner will proceed with verification, or advise Contractor that prerequisites are not adequately fulfilled.
 - .4 Fire Alarm Verification:
 - Assist and cooperate with Owner in verification procedure.
 - Provide following equipment:
 - Velometer.
 - Artificial Smoke.
 - Rate of Rise Heat Detector Tester.
 - Minimum of four portable communication devices.
 - .5 Do not proceed with verification unless the following parties are present at all times during verification procedure:
 - Electrical Contractor.
 - Fire Alarm System Manufacturer's Representative.
 - Owner's verification representative.
 - .6 Disassemble and reassemble system components.
 - .7 Disconnect and reconnect wiring.
 - .8 Perform required field adjustments.
 - .9 Repair defective work and replace defective components.
 - .10 Perform all other work on system required by verification procedure.
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Section 26 01 26

Maintenance Testing of Electrical Systems

3.8 Door Intercom System

- .1 Prior to function testing of system, perform following in conjunction with manufacturer:

- Check installation of all equipment.
- Terminate all wiring.
- Check system for clarity of audio.
- Ensure proper labelling of station.

- .2 Check all interconnections with other systems.
- .3 Record results on approved test report forms.

3.9 Cable Television

- .1 Confirm that installation and operation of all cable television equipment complies with specifications or manufacturer's recommended installation instructions.
- .2 Test TV signal at least one outlet on each splitter. Connect a TV to outlet and check each channel for picture clarity or test TV signal at one outlet on a loop system. Connect a TV to outlet and check each channel for picture clarity.
- .3 Record test results on approved test forms.

3.10 Door Monitoring System

- .1 Prior to function testing of system, perform following in conjunction with manufacturer:

- Ensure all equipment is properly installed and all terminations completed.
- Prior to testing, ensure all programming is complete and software is performing correctly.
- Ensure all magnetic locks, door contacts and card readers are operational.

- .2 Manufacturer shall function test system as follows:

- Door Supervision System:
Check installation and operation of all door contacts and control panels, including automatic dialer, if specified.

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Maintenance Testing of Electrical Systems

Confirm proper door labelling on all annunciators and main control.

Record results on approved test forms.

Card/Fob Access System

Check installation of all equipment.

Confirm operation of each door. Check door contacts, proper latching of magnetic locks, card operation and exit push buttons.

Confirm correct labelling of doors on annunciators, CRT monitor and in programming.

Confirm system programming and printer operation.

Check remote alarming via handsets.

Check all interconnections with other systems.

.3 Record results on approved test report forms.

3.11 Emergency System

.1 Arrange for Manufacturer to check installation of all equipment, terminate wiring and perform following:

Test software programming to ensure proper operation of all features.

Check identification of all equipment and ensure equipment is clean and dust free.

.2 Check all interconnections with other systems.

.3 Record results on approved test report forms.

3.12 Handset System if Applicable

.1 Ensure all equipment is properly installed and wiring correctly terminated. Check identification of all equipment.

.2 Ensure coverage meets specified limits.

.3 Ensure all units are fully charged prior to function testing system.

.4 Manufacturer shall function test system as follows:

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Maintenance Testing of Electrical Systems

Check equipment for proper operation. Transmit a call to one receiver. Check that call can be reached at any location within facility.

At furthest location from transmitter within facility, check each handset for reception of all calls.

Check all interconnections with other systems.

.5 Record results on approved test report forms.

3.13 Communications Cabling

.1 Check installation of all equipment.

.2 Ensure all cables are properly identified at each end and correctly terminated prior to testing as specified in Section 26 08 30.

END OF SECTION

ELECTRICAL SPECIFICATION

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Section 26 05 00

Common Work Results for Electrical

Section 26 05 00 - Common Work Results

PART 1. GENERAL

1.1 Intent (26 05 00)

.1 Work to be done under this Section shall include furnishings of labour, materials, and equipment required for installation, testing and putting into proper operation the complete Electrical systems as specified, as shown and as otherwise required. Complete systems shall be left ready for continuous and efficient satisfactory operation.

1.2 Submittals (26 05 00)

.1 Submit shop drawings and product data for products specified in this section in accordance with Section 26 01 00 - Electrical General Requirements.

1.3 Products (26 05 00)

- .1 Products shall be new, of Canadian manufacture where available, first quality and uniform throughout. Submit tender based on the use of products and equipment specified, or on the listed acceptable alternate equipment as further detailed.
 - .2 Electrical products shall be CSA. approved and be so labeled. Products not CSA approved shall receive acceptance for installation by the Local Authority Special Inspections Branch before delivery, and modifications and charges required for such acceptance shall be included in the work of this Section. Products shall not be installed or connected to the source of electrical power until approval is obtained.
 - .3 Where the manufacturer is not specified provide products of high commercial standard and quality consistent with the standards of these specifications. Provide products of same manufacture for like applications unless noted otherwise.
-

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Section 26 05 00

Common Work Results for Electrical

- .4 Products shall be designed and manufactured in accordance with the latest issue of applicable Standards or Authorities when such are either mentioned herein, or have jurisdiction over such materials or items of equipment. Confirm capacity, ratings and characteristics of the products being provided to supply power to equipment provided under other Sections of the work. Resolve discrepancies before such items are purchased.
- .5 Acceptance of products installed presumes that products have not been damaged or exposed to conditions that would adversely affect performance and life expectancy. If in the opinion of the Consultant, products have sustained damage, or have been exposed to abnormal conditions it shall be the responsibility of the Contractor to have such tests performed as deemed necessary by the Consultant to establish condition and therefore, acceptability of installed products.
- .6 Products shall match those identified on the Contract Drawings and Schedules. Substitutions or alternates shall not be supplied without formal written approval by the Engineering Consultant and Owner. Verbal approvals shall not be considered valid.

1.4 Related Sections (26 05 00)

- .1 Section 26 01 00: Electrical General Requirements

PART 2. PRODUCTS

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2.1 Electrical Identification (26 05 00)

.1 Cable and Conduit

- .1 Identify conduits and cables for the various systems by the use of the following distinctive coloured labels. The Labels shall comprise pressure sensitive plastic tape with printing labels indicating the system. Apply a small area of paint to the inside of each outlet box, pull box and panel as it is being installed. Identify junction boxes in suspended ceiling areas with colour on both inside and outside.

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Section 26 05 00

Common Work Results for Electrical

120/208 volt system - yellow

Fire alarm systems – red

Cable TV systems – purple

Telephone systems – blue

Security/Intercom/CCTV systems – black

Other telecommunication systems - grey

.2 Locate identification labels at follows:

Behind each access.

At each change of direction, at junction boxes, and at both ends of each run.

At not more than 15m apart in straight runs.

Where passing through a wall, partition, and floor. One on each side of wall, partition, and floor.

.2 Cable and Conduit Labels

.1 For power and lighting system feeders, install labels at either end of the conductors where terminated inside of equipment to match wiring diagram conductor identification or panelboard circuit numbers. Typical identification Panel AA circuit - 21; use "AA-21". For a three phase circuit provide identification on phase A conductor only. For a single phase circuit provide identification on the phase conductor.

.2 For lighting branch circuits identify circuit at panel and in outlet box connection to lighting fixture. Install label on phase conductor tap-off. Typical identification if fixture connected to Panel A, circuit 5; marker identification A-5.

.3 For branch circuits supplying single phase and three phase devices such as receptacles and connections to equipment identify conductors at panel and in device

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Section 26 05 00

Common Work Results for Electrical

outlet box. Install label on phase conductor inside outlet box. Typical identification if device is connected to Panel B - circuit 14, marker identification "B-14".

.4 For switchboards identify all control conductors at terminal strips inside equipment and where terminated at all remote devices. Identification shall match numbering system on Drawings and "Reviewed" shop drawings.

.5 For fire alarm systems, identify all conductors at terminal strips located in:

Control panels.

Annunciators.

Printers.

Local terminal cabinets.

All remote devices.

All connections in the system.

Provide identification in accordance with the numbering system on the "Reviewed" shop drawings.

6. For miscellaneous systems identify all conductors at terminal strips located in:

Control and/or monitoring panels.

Control and/or monitoring stations.

Local terminal cabinets.

All remote devices.

All connections in the system.

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Section 26 05 00

Common Work Results for Electrical

Provide identification in accordance with the numbering system on the "Reviewed" shop drawings.

.3 Equipment Nameplates

.1 Provide lamicoid name plates, white background with black engraved letters 0.4" (10 mm) high, for electrical equipment but not limited to panels, switchboards, transformers, disconnect switches, breakers, contactors, relay panels, starters, SPD, FACP and miscellaneous panels.

.2 Nameplates shall indicate voltage, capacity, upstream, and downstream equipment Typical identification for panel: "Lighting Panel C, 120/208 v, 3 phase, 4 W. Supplied from Panel BB".

.3 Switchboards - Plates to be mounted on face of switchboards. Typical identification for switchboard: "Switchboard AAA - 120/208 V, 3 phase, 4 W". Typical identification for branch feeders: "Power Panel BB".

.4 Install plates after all painting has been completed. Secure with mechanical fastening devices except on the inside of panel doors where gluing will be acceptable.

.4 Power System Colour Code

.1 Power system phase colour code:

Red - Phase A

Black - Phase B

Blue - Phase C

Neutral - White

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Section 26 05 00

Common Work Results for Electrical

Ground - Green.

- .2 Identify incoming utility service lines with enamel paint to above colour code.
 - .3 Band buses in switch board and panels to above colour code.
 - .4 Provide branch conductor to above colour code.
 - .5 **Manufacturer's Nameplates**
 - .1 Have the manufacturer's nameplates affixed to each item of all equipment showing the size, name of equipment, serial number and all information usually provided, including voltage, cycle, phase, horsepower, etc., and the name of the manufacturer and his address. Ensure that all stamped, etched or engraved lettering on plates is perfectly legible. Ensure that nameplates are not painted over. Where apparatus is to be concealed, attach the nameplate in an approved location on the equipment support or frame.
 - .2 Ensure that panels and other apparatus which have exposed faces in finished areas do not have any visible trade marks or other identifying symbols. Mount nameplates behind doors.
 - .6 **Signage**
 - .1 Provide signage to local inspection authority on all equipment and electrical rooms.
 - .2 The suitable warning signs must be installed as per Ontario Electrical Safety Code.
 - .3 Where applicable, provide warning signs for ground fault protection circuit as required by OESC section 68-068.
 - .4 Where applicable, provide warning signs and marking for the power disconnect switches for fire pumps as per NFPA-20, section 9.3.
 - .7 **Single Line Distribution Drawings**
-

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Section 26 05 00

Common Work Results for Electrical

- .1 Provide clear acrylic covered framed as-built single line distribution system drawing of the entire project in the main electrical room. Distribution system shall be CAD generated. Size shall be minimum 305 x 460 mm with all text legible. Provide interim drawings until such time that permanent as-built drawings are available for permanent installation.
- 2.2 Wires And Cables (26 05 00)
- .1 Comply with the requirements of the latest editions of the following:
- CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
 - CAN/CSA-C22.2 No.131 – Type TECK 90 Cable.
 - CSA C22.2 No. 38, Thermoset Insulated Wires and Cables.
 - CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables
 - CSA C22.2 No. 65, Wire Connectors.
- .2 Use copper conductors T90 or RW90, 90oC rated insulation unless otherwise noted.
- .3 Aluminum conductors RW90 (90°C rated insulation) or NUAL RW90 Nexans may be used where noted, for loads in excess of 40 amp in sizes #2 AWG and larger, applied with corrosion preventing compound and hydraulic or powder activated tools, are used for all connections. Where aluminum conductors used for specified copper conductors, electrical contractor is responsible to provide larger conduits as required by Code, size conductors to meet design requirements of capacity and voltage drop. All changes shall be clearly noted by contractor on the as-built drawings.
- .4 Solid conductors of #12AWG and smaller. Stranded conductors for #10 AWG and larger.
- .5 Except as indicated hereinafter, wire for 120 volt lighting and receptacle branch circuits to be #12 AWG except that #10 minimum to be used where the home run exceeds

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Common Work Results for Electrical

27m (90'). Wire for 120 volt control circuits to be #12 AWG minimum, and for 24 volt control circuits to be #16 AWG minimum.

.6 For wiring through or in lighting fixtures use type 'GTF' fixture wire, rated 600 volts to meet code requirements for recessed fixtures.

.7 Cables located in plenum, ceiling or floor spaces shall be totally enclosed in non-combustible conduit or raceway or be armored cable where permitted by the Ontario Building Code.

.8 Unless specified otherwise, wire for branch circuits shall be 2#12 + GRD in 16mm EMT conduit.

.9 Wires and cables for outdoor locations shall be minus 40°C rated.

.10 Armored cables shall be complete with interlocked aluminum armor, approved fastening and connectors and meet the requirements of Vertical Flame Test-Cables in Cable Tray of CSA C22.2 No. 0.3. The PVC jacket cables (TECK 90 and ACWU90) shall be FT6 rated.

.11 Install all wiring in conduit, unless indicated as armored. Route wire and cable to meet Project conditions. Use suitable cable fittings and connectors.

.12 Use an approved lubricant to assist in pulling conductors through conduit. Neatly train and lace wiring inside boxes, equipment and panelboards.

.13 Balance the loading on feeders so that unbalanced load is less than 10%.

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Common Work Results for Electrical

.14 Limit the voltage drop at the end of feeders and branch circuits to 2% at the rated load of the circuit.

.15 For single conductor armored cables, where required to conform to the Electrical Safety Code, Rule 12-108, Bulletin 12-7-11.

.16 Lighting fixture wiring in accessible ceiling spaces shall be run in conduit from the lighting panel to ceiling outlet boxes with armored cable drops no longer than 3.0m (10 ft.) permissible from the boxes to fixtures.

.17 Splice wire, up to and including No. 6 gauge, with nylon insulated expandable spring pressure type connectors. Splice large conductors using compression type connections insulated with heat shrink sleeves.

.18 Regardless shown or not on the drawings, all wiring for emergency systems shall be protected by one (1)-hour rated enclosure unless otherwise noted, in accordance with the Ontario Building Code and authorities having jurisdiction. This will include but not necessarily be restricted to the following systems:

Fire alarm system. Trunk wiring and main risers, not including branch wiring to terminal devices within a fire zone.

All power and control wiring to fire fighting pumps, if any.

Equipment used for the purpose of smoke venting, if any; all power and control trunk wiring for all the fans, and associated dampers and powered doors.

Power and control wiring for all pressurization fans, and associated dampers and powered doors, if any.

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Wiring related to supply of emergency power to elevators, if applicable.

Feeders to emergency panels, if any.

Power supply to fire alarm panel.

Power supply to any other life safety loads, as applicable.

.19 Where a one (1)-hour fire rating is required, this may be achieved by:

Installing conduit in rated separate electrical service shafts and/or electrical rooms.

Installing conduit embedded in building concrete structure to provide one-hour rating. The depth of concrete structure protecting cable shall be around 50mm, or pre-approved by Building Inspector.

Provide one (1)-hour rated enclosure where cable turn out from concrete structure.

2.3 Raceways And Fitting (26 05 00)

.1 Drawings do not show all raceways. Those shown are generally in diagrammatic form only.

.2 Comply with the requirements of the latest editions of the following:

CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

CSA C22.2 No. 45, Rigid Metal Conduit.

CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

CSA C22.2 No. 62, Surface Raceways and Lighting Fixture Raceways and Fittings.

CSA C22.2 No. 83, Electrical Metallic Tubing.

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CSA C22.2 No. 126, Cable Tray System.

CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.

CSA C22 No. 18, Outlet Boxes, Conduits Boxes, Fittings and Associated Hardware.

.3 Conduits

.1 Rigid steel conduit hot dip galvanized inside and outside installed:

On the exterior of building;

Where exposed to mechanical damage;

Where conduits turn up or turn down out of concrete slab;

Damp and wet locations.

.2 Steel galvanized electrical metallic tubing (EMT) installed:

In partitions;

In ceiling spaces;

In service spaces.

In masonry walls.

.3 Rigid PVC (unplasticized) conduit except for exit light, emergency lighting, and fire alarm system installed:

In slabs with rigid steel galvanized turn-up;

Underground with rigid steel galvanized turn-up;

In concrete walls;

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Damp and wet locations.

.4 Flexible armoured conduit:

In partitions;

For lighting fixture drops;

From ceiling junction boxes into wall outlets;

Flexible armoured conduits shall be limited to 10'-0" lengths where run horizontally from take-off junction boxes.

.5 Liquid tight flexible conduit

Final connection to motors.

Any equipment which vibrates or generates noise.

.6 Drive-FX Nexans cable shall be used where connections to variable speed/frequency VFD/VSD devices.

.7 For EMT use steel concrete tight set screw fittings as manufactured by T&B or equal. Die cast or pressure cast fittings are not acceptable. For rigid steel conduit use only steel or malleable iron threaded fittings. Threadless, die cast or pressure cast fittings are not acceptable.

.8 ENT might be used where permitted by OESC, provided with mechanical protection as required by OESC.

.9 Provide bushings on the ends of all conduits in enclosure, boxes, panels and cabinets, to protect the conductor installation. Except where grounding bushings are specified, use all plastic insulated bushings temperature rating 150°C with double locknuts.

.10 Use PVC conduit for all landscaping locations where conduit comes in contact with soil. Refer to Landscape Drawings for final elevation of planting soil. Co-ordinate and adjust electrical devices accordingly.

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Section 26 05 00

Common Work Results for Electrical

- .11 Conceal all conduits except in service spaces, mechanical rooms, electrical rooms and areas with ceilings.
- .12 Install all locknuts and bushings to ensure a secure mechanical and electrical bond. Use Erickson couplings in lieu of running threads.
- .13 Where conduit joints occur in concrete, use silicone sealing compound to make water tight.
- .14 Lay out conduit to drain free of all moisture.
- .15 Securely hold conduits in place in concrete or masonry during pouring and construction operations; provide templates, forms and spacers as necessary.
- .16 Support multiple runs of conduit on channel or angle iron with rod hangers.
- .17 Secure all conduits in place with conduit clamps T & B or equal. Perforated pipe straps, wire lashings, wood screws or nails are not acceptable.
- .18 Provide conduit expansion joints where conduits cross building expansion joints, also in straight runs of conduit 30 m (100') or longer. Conduit expansion joints shall be telescoping sleeve type, with insulated bushings and ground jumper.
- .19 Make field bends and offsets uniform and symmetrical without flattening conduit. Minimum bending radius shall be ten (10) times the conduit diameter.
- .20 Ream conduit ends to remove burrs and sharp edges. Fit conduit stubs with waterproof plastic caps during installation to protect threads and to prevent entrance of moisture into conduit.
- .21 Test all conduits for clear bore using ball mandrel, brushes and snake. Clear any conduit which rejects the ball mandrel. Replace if necessary. Bear all costs involved in making all work good, restoring all surfaces to original condition.
- .22 Install a continuous nylon cord 180 kg (400 lb) test in each conduit left empty.
- .23 Install a copper ground conductor within the flexible conduit at each connection.

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- .24 Provide conduit seals in conduits which pass to the outside.
 - .25 Provide pull boxes, fittings or junction boxes in conduit runs, on the basis of not more than two (2) right angle bends or their equivalent or not more than 30 m (100'), in straight runs between boxes. For outdoor direct buried conduit, up to 50m.
 - .26 Size conduits to code requirements, provide larger sizes where noted.
 - .27 Size conduits for low voltage wiring to manufacturer's recommendations.
 - .28 Provide conduit sealing fittings and correspond for hazardous application to Electrical Safety code requirements.
 - .29 Maximum conduit size permitted in a concrete slab shall be 35 mm. In any case verify with Structural Consultant for acceptability.
 - .30 Where multi-conduits parallel run and/or crossover in concrete slab/wall, verify with Structural Consultant for acceptability.
- .4 Cable tray
- .1 Provide cable tray only where noted on the drawings.
 - .2 Cable tray shall be continuous, welded steel wire mesh, and cable tray with the following features:
 - Permits continuous ventilation of cable and maximum dissipation of heat.
 - Continuous safety edge T-welded wire lip.
 - Welded at all intersections.
 - Straight sections shall be minimum 4" x 12" (100mm x 300mm) in configurations unless otherwise noted.
 - constructed of carbon steel wire, ASTM A 510, grade 1008. Wire welded, bent, and surface treated after manufacture.

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Post fabrication finish of electro-plated zinc galvanizing: ASTM B 633, Type 111, SC-1.

Fittings: Field fabricated in accordance with manufacturer's instructions from straight sections.

- .3 The support system shall be Cablofil Field Mate hanger system or approved equal. The necessary hardware, including splice connectors and support components furnished by manufacturer.
- .5 Surface metal raceway
 - .1 The surface metal raceway systems shall consist of surface metal raceway, appropriate fittings and device brackets to complete installation.
 - .2 The raceway is to be utilized in dry interior locations only as per Ontario Electrical Safety Code.
 - .3 Submit drawings for approval showing the complete layout of all products that make up the complete system for each floor prior to installation with raceway lengths, device type (power and data), locations and circuits identified, complete with data sheets and samples.
 - .4 The surface raceway system specified herein for branch circuit wiring and/or data network, voice, video and other low-voltage wiring shall be Hubbell HBL4750 series or Wiremold V4000 Series or approved equal. The raceway shall be metal, two-piece design with a base and a snap-on cover. The raceway shall be complete with one integral barrier in the base for power/data separation. Power shall be in top; data in the bottom. Finish shall be ivory unless otherwise noted.

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- .5 For individual devices located on surfaces where conduit cannot be recessed provide single or double channel raceway system products.
- .6 Receptacle / Data plates shall be Legrand Wiremold V4047 series or approved equal.
- .7 Exposed raceway in finish area (not in service spaces, mechanical/Electrical room, ceiling, etc) shall be: Hubbell HBL500 series or Legrand Wiremold V700, or approved equal, ivory finish.
- .6 Install raceways system complete with appropriate fittings such as connectors, bushings, elbows, couplings, locknuts, expansion fittings, fasteners and supports and accessories supplied as integral parts of assembly, as specified. Installation shall comply with Regulatory Authorities requirements.
- .7 Neatly install exposed raceway running parallel to and at right angles to building lines and equally spaced in groups.
- .8 Keep raceway ends parallel and on proper spacing to suit knockouts or raceway openings in equipment or enclosure.
- .9 Keep raceways at least 150 mm clear of heating pipes, flues and hot item surfaces. Where required clearance cannot be provided, obtain written approval from engineer to alter layout or to reduce clearance.
- .10 Provide expansion couplings, with bonding jumper and ground clamps where raceways cross building control joints.
- .11 Use only metallic, enclosed raceway on installation that required shielding of electrical cables or where installed in ceiling used as return air plenum, as specified or indicated on Drawings.

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- .12 Raceways shall have established positive low resistance paths to ground and effectively isolate conductors so that any short-circuit arc is confined.
- .13 Select appropriate fittings, such as grounding bushings, bonding and grounding straps, to maintain continuity and effectiveness of grounding of raceway system.
- .14 Provide necessary fasteners and supports acceptable for type and size of raceways, to ensure rigid, complete assembly.
- .15 Provide suitable inserts or expansion type machine bolts for fastening raceways, fittings, boxes and equipment to concrete surfaces.
- .16 Do not use wood screws, lag screws, expansion shields, rawl plugs and nylon inserts.
- .17 Secure raceway and other associate work to structure members. Raceway shall not be supported from ceiling suspension system.
- .18 Thoroughly clean raceway and dry clear obstructions before pulling cable or wire.
- .19 Minimum raceway size: 16mm (1/2") conduit equivalent system.

2.4 Outlet And Conduit Boxes (26 05 00)

- .1 Comply with the requirements of latest edition of the followings:
 - .1 CSA Standard C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CSA Standard C22.2 No. 85, Rigid PVC Boxes and Fittings.
- .2 Outlet and conduit boxes - general
 - .1 Size boxes in accordance with CSA C22.1.
 - .2 102mm square or larger outlet boxes as required for special devices.
 - .3 Gang boxes where wiring devices are grouped.
 - .4 Blank cover plates for boxes without wiring devices.

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- .5 347V outlet boxes for 347V switching devices.
 - .6 Combination ganged boxes with appropriate steel removable barriers where outlets for more than one system are grouped.
 - .7 Where standard make boxes are not suitable, provide boxes of special design to fit space and other requirements.
 - .8 Where vapour proof lighting is specified, provide matching vapour proof ceiling or wall junction boxes and fittings as required.
- .3 Sheet steel outlet boxes
- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm or as indicated. 102mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
 - .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48mm.
 - .3 102mm square or octagonal outlet boxes complete with steel fixture studs where supporting lighting fixtures. Die cast fittings not permitted.
 - .4 102mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.
- .4 Masonry boxes
- .1 Electro-galvanized stamped steel masonry single and multi gang boxes for devices flush mounted in exposed block walls, minimum size 95x 50 x 64mm standard and 102 x 57 x 61mm for 347V.
- .5 Concrete boxes
- .1 Electro-galvanized stamped steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.
- .6 Floor boxes as specified on Drawings

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- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear receptacles. Minimum depth: 28mm for receptacles; 73mm for communication equipment.
 - .2 Round (Floor Mount): 84mm x 63mm deep minimum complete with side and bottom knock-outs.
 - .3 Rectangular: one, two, or three gang flush device floor boxes minimum size 110 x 81 70mm removable barriers for power/low voltage cables, complete with side and bottom knockouts.
 - .4 Multi-Outlet: Electro-galvanized tamped steel concrete type, combination power / communication, flush mounting complete with modular device plates, side and bottom knockouts, lift-up cast aluminium recessed cover and cable lid, black epoxy powder finished 229x257x76mm deep, or 64mm deep.
 - .5 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16mm and 21mm conduit.
 - .6 Raised Access Floor Boxes
 - .1 Electro-galvanized steel, combination power and communication. Flush in raised floor tile complete with lift-up cast aluminium recessed cover and cable lid. Modular device plates, 254m flexible armoured cable and plug for power
 - .2 Dimensions: 203 x 152 x 114mm.
 - .7 Conduit boxes
-

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Cast FS or FD aluminium, or ferroalloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

PVC FS or FD boxes or PVC conduit where required in special corrosive areas as indicated on Drawing.

.8 Fittings - general

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

.9 Installation

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come with 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washer are not allowed.
- .5 Size and install appropriate boxes and enclosures in accordance with applicable section(s) of Ontario Hydro Electrical Safety Code and manufacturer's recommended procedures.
- .6 Co-ordinate location and installation of boxes so as to be accessible and clear from building system equipment, etc.
- .7 Install pull boxes in inconspicuous but accessible locations.

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- .8 Use pull boxes for conduits larger than 35mm. Use conduit outlet bodies for conduit 35mm.
- .9 Provide approved hole plugs in unused conduit knockouts and openings.
- .10 Furnish boxes and enclosures with corrosion resistant machine screws.
- .11 Boxes and enclosures embedded in concrete for flush-mounted, shall be secured properly with connecting conduits and related works set in place before concrete is poured. Forms, when used, shall be able to be removed without disturbing installed boxes or enclosures.
- .12 Ensure junction and outlet boxes mounted in ceiling cavities do not interfere with removal of ceiling tiles.
- .13 Use masonry boxes for flush mounting in exposed block walls, concrete boxes for flush mounting in concrete wall.
- .14 Furnish conduit boxes with neoprene gaskets for outdoor area or hazardous area application.
- .15 Install all wall boxes for door security access devices, fire alarm devices, etc., adjacent to lock side of door openings unless otherwise shown. Check door swing before installing any switch.
- .16 Install all boxes in walls so that tapped holes for mounting wiring devices or fixtures will be aligned vertically or horizontally, as required. Where boxes are grouped at one location with common and varying mounting heights, align boxes horizontally and vertically from centre line unless otherwise indicated.
- .17 Offset outlet boxes in sound attenuating partitions to avoid undue transmission of sound between the partition elements. Use flexible conduit connections where wiring is required between outlet boxes on opposite sides of partition.
- .18 Offset outlet boxes where installed on either side of a fire separation.

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.19 Where steel supports are required for outlet boxes, wood supports are not acceptable.

.20 Maintain integrity of vapour barriers along building perimeter wall where flush outlet boxes are required.

2.5 Access Panels And Doors (26 05 00)

- .1 All access panels and doors to be with concealed hinges, as specified by Architect.
- .2 In glazed tile walls provide #304 alloy stainless steel with #4 finish recessed frame and secured with stainless steel countersunk flush head screws.
- .3 In plaster surfaces provide dished steel door for plaster finish with welded metal lath and plastic grommet for keyhole.
- .4 In other finishes use plain steel door with lock and anchor straps, complete with factory prime coat.
- .5 In lay-in ceilings, tiles properly marked may serve as access panels.
- .6 Provide the appropriate Division of Work with panels and doors, complete with frames and all pertinent information for installation. Arrange and pay for that Division to install them. Ensure that all panels and doors are flush mounted and properly aligned with building modules and grids. Indicate locations on record drawings.
- .7 Select all access panels and doors to provide adequate access, and to suit appropriate architectural finish, minimum size 150 mm x 150 mm (6" x 6"). Where necessary for persons to enter, provide minimum 600 mm x 450 mm (24" x 18") size doors.

2.6 Sprinkler Proof Equipment (26 05 00)

- .1 Provide all equipment in this project with accessories to prevent the entry of water into the enclosures in the event that the sprinkler system is activated. The entire building spaces are sprinklered.
- .2 Materials

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- .1 CSA enclosure type 2.
 - .2 Louvres facing outward and downward where openings are required for heat dissipation. Expanded metal screening is not acceptable.
 - .3 CSA certified sealing rings for rigid steel galvanized conduit and CSA certified raintight connectors for steel galvanized electrical metallic tubing (EMT) or other raceways as required.
 - .3 Provide seal rings and watertight connectors on all conduit terminations entering the top or side of all enclosures and for all conduit terminations for pull boxes, junction boxes, splitter troughs, wireways, auxiliary gutters, cable troughs and disconnect switches installed below the level of the sprinkler heads.
- 2.7 Backboards (26 05 00)
- .1 Provide backboards for all surface mounted power distribution equipment.
 - .2 Provide backboards for telecommunication systems.
 - .3 Backboards shall be minimum 0.76" (19mm) thick, good one (1) side fire retardant plywood backboards, pressure impregnated with fire retardant chemicals, and stamp. Conform to CSA 080.
 - .4 Construct each backboard in a rectangular shape of the size as indicated. Where no size is indicated, provide a backboard a minimum 4" (100mm) higher than the equipment. Where more than one (1) piece of equipment is installed on the backboard, construct the backboard of a size to suit the maximum vertical and horizontal dimensions of the equipment. Backboards for Telecommunication system shall be minimum 4" (W) x 4" (H).
 - .5 Finish each backboard with one (1) coat of primer followed by a minimum of one (1) finish coat of ASA 61 grey paint prior to installing any equipment.
 - .6 Fastenings:
 - .1 Fasten each backboard to a wall or to a support structure using cadmium plated hardware. Provide a flat washer under the head of each fastener. Recess the

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head of the mounting bolt where equipment, including future equipment is to be installed.

.2 Use expansion shields, toggle bolts or other types of wall fastenings to suit the wall type. Align the mounting bolts with the wall studs for stud type walls.

.3 Install fastenings a maximum 20" (500mm) apart in both the vertical and horizontal directions.

.4 When installing equipment heavier than 50kg, fasten the equipment through the backboard directly to the wall or support structure.

2.8 Metals (26 05 00)

.1 Metal construction required for the electrical work shown on the structural drawings will be carried out by Division 5.

.2 Provide all other electrical work such as, but not limited to, equipment bases, supports, catwalks, framework to support checker plates and electrical equipment above trenches and cable pits, ladders, etc. pit and trench covers, and as called for on the Electrical Drawings. Have such work carried out in accordance with the requirements of Division 5.

2.9 Sleeves And Curbs (26 05 00)

.1 Provide conduit sleeves of galvanized steel for conduit and cable runs passing through concrete walls, beams, slabs and floor. Cut flush with finished surface.

.2 Extend galvanized conduit sleeves for conduit rising through slabs 4" minimum above finished floors.

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- .3 Through exterior walls below grade waterproofed floors, and other waterproof walls use heavy weight cast iron pipes machine cut. Extend sleeves 100 mm (4") above finished floors, and cut flush with underside of floor.
- .4 For rectangular duct openings for bus ducts and cable tray use minimum 18 gauge galvanized steel sleeves or provide a removable wood box-out of the required size. Brace sleeves to retain their position and shape during the pouring of concrete and other work.
- .5 Seal sleeves and openings to maintain fire rating. Use Dow-Corning #3-6548 'Silicone RTV' foam, Thomas & Betts 'Flamesafe' firestop system or 3M, installed in accordance with the manufacturer's specifications and recommendations.
- .6 Seal all openings and sleeves after installation of equipment:
 - .1 With an approved material to maintain fire rating where sleeves and openings pass through fire separations and floors.
 - .2 With an approved material to maintain fire rating for sleeves and openings provided for future equipment.
- .7 Size sleeves to provide 13 mm (1/2") clearance all around.
- .8 Provide all flashing and waterproofing for sleeves through roof and exterior walls to the requirements of Division 7, Thermal and Moisture Protection.
- .9 Except where furred in provide watertight concrete curbs, 100 mm (4") high by 100 mm (4") wide with 19 mm (3/4") chamfered edges around all sleeves and openings passing through waterproof floors.

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2.10 Supports And Bases (26 05 00)

- .1 Submit proposed method of attachment of hangers and beam clamps, to cellular steel deck for approval before proceeding with Work.
- .2 Supply and erect special structural Work required for the installation of electrical equipment. Provide anchor bolts and other fastenings unless noted otherwise. Mount equipment required to be suspended above floor level, where details are not shown, on a frame or platform bracketed from the wall or suspended from the ceiling. Carry supports to either the ceiling or the floor, or both as required, at locations where, because wall thickness is inadequate, it is not permitted to use such brackets.
- .3 Electrical panels, switches or other electrical equipment shall be complete with suitable bases or mounting brackets.
- .4 Provide channel or other metal supports where necessary, to adequately support lighting fixtures. Do not use wood unless wood forms part of the building structure.
- .5 Secure supports, in general to structure, from inserts in concrete construction or from building structural steel beams, using beam clamps. Provide additional angle or channel steel members, required between beams for supporting conduits and cables.
- .6 Provide any additional support required from existing concrete construction for any piping or equipment, by drilling same and installing expansion bolt cinch anchors.
- .7 Do not use explosive drive pins in any section of Work without obtaining prior approval.

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.8 Hangers for electrical conduit shall be galvanized after fabrication. Conduit hangers shall be as manufactured by:

Burndy Canada Ltd.

Canadian Strut Products Ltd.

E. Myatt & Co. Ltd.

Steel City Electric Co.

Pilgrim

Thomas & Betts

B-line

.9 Do not use perforated strapping (grappler bars).

.10 Steel supports in wet or dry locations to be galvanized after fabrication.

.11 Provide concrete housekeeping pads or bases for all floor mounted equipment 100 mm (4") high with 19 mm (3/4") chamfered edges, keyed to the floor slab and extending at least 100 mm (4") on all sides of the equipment. Where draw-out truck type circuit breakers are provided extend pad to accommodate complete withdrawal of breaker. Provide and set all anchor bolts.

.12 Use only factory made threaded or toggle type insert.

.13 Place inserts only in structural members and not in the finishing material.

.14 Provide bus ducts, cable trays, and wireways with fire barriers at each floor level and fire separation.

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.15 Provide locations and dimensions for all pads and curbs and provide and set all anchor bolts for all concrete work provided under Division 3, Concrete.

2.11 Spare Parts (26 05 00)

.1 Furnish spare parts and maintenance materials as recommended by the equipment manufacturer and as appropriate for a period of two (2) years after acceptance of the Work.

PART 3. EXECUTION

3.1 Neutrals And Phasing (26 05 00)

- .1 Provide one (1) identified grounded neutral conductor for each set of branch circuits connected to different mains of each panel.
- .2 For circuits identified as computer dedicated (D) or isolated ground (IG), provide individual neutral per identified circuit.
- .3 Install a separate neutral for each GFCI circuit when the GFCI is located at the panelboard.
- .4 The practice of connecting two or three (2 or 3) circuits sharing a common neutral to different mains or phases is strictly forbidden.
- .5 Balance the connected loads across the mains of each panel to within 15%.
- .6 Circuit numbers on the panels must correspond to the numbers on the Drawings.
- .7 Connections in all equipment to be Phase A, B and C from left to right, and front to back when viewing from the front or accessible direction.

3.2 Mounting Heights (26 05 00)

.1 Mounting heights are from floor level to centre line of device outlet, unless noted otherwise. Confirm all locations before installation. In all areas accessible to persons in

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wheelchairs, the mounting heights of all switches, thermostats, intercom switches, pull stations, etc. required by Building Code "Barrier Free" shall comply with Code requirements.

.2 The mounting heights of all power and lighting devices shall comply with local and Provincial Electrical Safety Code requirements. The mounting heights of all fire alarm devices shall comply with CSA requirements.

.3 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.4 Install electrical equipment at following heights (centre of device) unless indicated otherwise on Architectural Drawings.

.1 Wall switches, dimmers, timers, speed controllers, speaker volume controllers, thermostats and hand dryers: 1100 mm.

.2 Wall receptacles:

General: 350 mm.

Above top of continuous baseboard heater: 250 mm.

Above top of counters or counter splash backs: 250 mm.

In mechanical rooms: 1100 mm. (gang with switch)

.3 Panelboards: as required by Code or as indicated.

.4 Telephone, TV and data outlets: 350 mm.

.5 Wall mounted Interphone outlets: 1100mm.

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- .6 Wall mounted speakers: 150 mm below ceiling.
- .7 Door bell push buttons and door open push buttons: 1100 mm.
- .8 Security key switches, card readers and intercom switches: 1100mm. .
- .9 Security wall-mounted motion sensor: 2300mm.

3.3Wiring Of Mechanical Equipment (26 05 00)

- .1 Co-ordinate all the work with Mechanical Division. The locations of starters, motors and associated equipment indicated on the drawings are approximate and diagrammatic only. Co-ordinate with the work of the Mechanical Division Trade Sections to ensure proper location of equipment. The exact locations of conduit terminations at Mechanical units shall be determined from equipment manufactures' approved shop drawings. Conduits must be installed to enter only in the locations designated by equipment manufactures.
- .2 Provide all electric baseboard heaters, cabinet heaters, force flow unit heaters and heating cables. Mechanical Division shall provide electric duct heaters.
- .3 Provide suitably rated safety disconnect switches within 1m of motors whether shown on the drawings or not. Provide power wires and connections to all mechanical equipment.
- .4 All the motor starters/controllers, and/or line voltage thermostats shall be supplied by Mechanical Division and installed by Electrical Division. Electrical Division shall provide safety disconnect switches and power connections to the motors. Mechanical Div. shall provide all the control wiring, control devices and low voltage thermostats.

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- .5 Where motor starters, switches and the like, are grouped together, provide suitable plywood backboard to which all such equipment shall be secured.
- .6 Where the single-phase exhaust fan shall be controlled by manual switch, Electrical Division shall provide power connections to the fan, heavy-duty toggle control switch and provide the safety disconnect means.
- .7 Wiring and connections from fire alarm system to motor starters/control panels for motor control operations. Co-ordinate with Mechanical Division.
- .8 Use Drive-FX Nexans for connections to VFD's.

3.4 Elevator Services (26 05 00)

- .1 Comply with the requirements of the latest edition of CAN/CSA-B44, Safety Code for Elevators. Comply with the requirements of the latest edition of the Local Provincial Electrical Safety Authority Code.
- .2 Provide power wiring to the elevator controllers which include fused disconnect switches for main power, signal and car lighting. Final roughing-in and equipment locations shall be verified in accordance with final elevator shop drawings and installation drawings, and shall meet codes requirements.
- .3 Provide grounding connections to elevator systems as required by codes.
- .4 Include in tender price providing an additional GFI receptacle complete with power supply from a separate breaker in nearby power panel. Locate receptacle as required by elevator shop drawings for remote monitor unit.
- .5 Provide wires (4#12AWG C) in 21mm conduit from the elevator controllers to two (2) contacts in the transfer switch providing power to the elevators. One contact is for transfer signal, open on normal power and close on emergency power. One for pre-transfer signal, normally open and close 10 seconds prior to transfer onto

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- emergency power and back to normal power, and this contact should reopen immediately after the actual transfer of power.
- .6 Sequencing in elevator controllers to be provided to allow only one elevator to operate at a time while on emergency power.
 - .7 Provide in elevator pit and top of elevator shaft lighting fixture and switch, GFI receptacle, and fire detector. Fire alarm detectors shall be complete with auxiliary contact (N.C.) connected to elevator controller for emergency sequencing signal.
 - .8 Provide phone outlet box and conduit for each elevator controller.
 - .9 Provide connections from the fire alarm system to signal elevator controllers to commence the fire sequence as defined under the elevator specifications. Co-ordinate with elevator supplier and ensure connections and signal provided meet the requirements of CSA Standard B44.
 - .10 Provide fire alarm smoke detector complete with auxiliary contact (N.C.) connected to elevator controllers in each elevator lobby.
 - .11 Provide two (2) 27 mm empty conduits beside each elevator controller from the CACF room FACP location. The conduits are for the two-way communication and elevator controls. Terminate conduits in wall mounted recessed boxes at 1100mm AFF.
 - .12 Provide one (1) 27mm empty conduit beside each elevator controller room from main telephone backboard for telephone company connections.
 - .13 Provide one (1) 27 mm (1") empty conduit/sleeve from a recessed junction box at 1100mm AFF in elevator lobby on ground floor to each elevator shaft.
- 3.5 Services To Equipment Supplied By Owner / Other Divisions (26 05 00)**
- .1 Provide all necessary connections required for equipment supplied by the Owner and other Divisions. Examine all Drawings and Specifications and identify all requirements.

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.2 Verify the type, rating and location of all outlets and/or connections required for all equipment provided by the Owner and other Divisions.

.3 Provide isolation devices as required to the equipment for all services.

3.6 Provision For Future Equipment And Construction (26 05 00)

.1 Spaces designated for future equipment or building expansion shall be left clear.

.2 Provide services for future extensions complete with Products necessary for present termination and to permit future extension.

.3 Identify each service by a permanent marker at its termination point.

3.7 Cutting And Patching (26 05 00)

.1 Provide all cutting and patching required for the Work of Electrical Division. Work shall be carried out in conformance with the requirements of Division 2. Include any radiography required to locate concealed services before penetrating into inaccessible locations.

.2 Any modifications to building shall be done so as not to diminish structural, fire resistance, or smoke barrier integrity.

.3 Proposed modifications to structure shall require acceptance by the Structural Engineer.

.4 Consultant shall be afforded the opportunity to review the intent prior to any major cutting.

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3.8 Painting (26 05 00)

.1 Provide all exposed ferrous metal work, and Products, except conduit, with at least one (1) factory prime coat or paint one prime coat on site. Clean up or wire brush all equipment before painting. Unless otherwise noted finish painting will be done under Division 9, Finishes of these Specifications.

.2 If not factory coated, clean, wire brush and paint all ferrous supports and hangers concealed in ceiling spaces of kitchens or other similar high humidity areas. Do not paint galvanized supports and hangers.

.3 Repaint or refinish all damaged factory applied finishes.

.4 Provide oil base red oxide primer applied as per manufacturer's recommendations.

3.9 Vibration And Noise Control (26 05 00)

.1 Spring type vibration isolations shall be complete with horizontal spring constant (kH) to vertical (kV) ratio between one and two to assure stability. Select springs to operate no greater than 2/3 solid deflection. For indoor mounting use springs with one (1) coat of zinc chromate primer and two (2) coats of paint. For outdoor mounting use springs of neoprene coated steel or stainless steel. All spring housings to be hot dipped galvanized. Where the spring assembly is bolted to the floor provide vibration isolation washers and pads to reduce transmission of vibration.

.2 Pad type isolators shall be rubber for indoor application, neoprene for oil filled devices and for outdoor use. Use 30 durometer rubber and 50 durometer neoprene. Select pad type isolators which do not exceed the mid-point of their recommended operating rate

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with maximum deflection of 20% of thickness. Use minimum 6 mm (1/4") thick pads under spring assemblies.

.3 Provide spring type vibration isolators for IC engine driven equipment. Raise equipment to operating height, levelled with blocks and shims so that connections can be made to a rigid system at operating level before isolator adjustments.

.4 Provide pad type isolators for all floor mounted dry type distribution transformers. Locate isolators between transformer enclosure and floor.

.5 Where transformers are platform mounted from structure above provide spring hangers with levelling devices and sound pads in all supports.

.6 Make connections to rotating, vibrating, magnetic or other noise producing equipment such as motors, transformers, and between independent structures by means of loop flexible conduits.

.7 If objectionable noise or vibration should be transmitted to occupied portions of the building by any part of the electrical work, make necessary changes and/or additions, to the Consultant's approval, without addition to the contract price.

3.10 Concrete (26 05 00)

.1 Concrete work shown on the structural drawings will be done as part of Division 3, Concrete of these Specifications.

.2 Provide all other concrete work necessary for the Work of this Division. Have such work carried out in accordance with Division 3, Concrete of these Specifications.

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3.11 Excavation And Backfilling (26 05 00)

- .1 Before commencement of excavation of the Work, determine with the Consultant, the municipalities and utilities, the presence of existing underground services at the site and verify satisfactory condition. Locate such services and mark out same. Ensure that all trades concerned are aware of their presence.
- .2 Do all excavation and backfilling up to grade required for the electrical work inside and outside of building. Check available soil test reports. Obtain instructions of the Consultant regarding the type of soils and their extent.
- .3 Carry out all trench excavation in strict conformity with all applicable acts and bylaws.
- .4 Excavate to the required depth and width. Backfill excess excavation.
- .5 For direct buried cable in all soil conditions excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the cable run. Fill back with a bedding of granular 'A' gravel or sand.
- .6 Provide ducts under roads and paved areas.
- .7 Refer to details and to Utility Company requirements for concrete encased duct installations.
- .8 Where excavation is necessary in proximity to and below the level of any footing, provide a sleeve at the proximity and backfill with 14,000 kPa (2,000 psi) concrete to the

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level of the highest adjacent footing. Proximity is determined by the angle of repose as established by the Consultant.

.9 Protect the bottom of excavations against flooding and freezing. Use pumping or other means to keep bottom dry. Do not open more than weather will permit. Have excavations inspected at least once a week by authorities. Break up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless approved in writing by the Consultant.

.10 Compact all backfill to a density of 95% Modified Proctor. Before backfilling, obtain approval. Remove all shoring during backfilling. Obtain approval for all compaction machines used.

.11 Backfill trenches within building, with clean sharp sand in individual layers of maximum 150 mm (6") thickness. Manually compact the first layers up to a compacted level of 300 mm (12"). Machine compact the balance up to grade, using approved equipment.

.12 Backfill trenches outside buildings, not under roads, parking lots, or traffic areas, manually compact up to a compacted level of 450 mm (18") above the cable or duct bank with individual layers of material up to 150 mm (6") thick, using sand or granular 'A' gravel. Machine compact the balance up to grade with 150 mm (6") layers of approved excavated material.

.13 Backfill all other trenches outside buildings with granular 'A' gravel in layers not exceeding 150 mm (6") thickness, up to grade level; manually compact up to 450 mm (18"), machine compact the balance.

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.14 Do not use water for consolidation or during compaction of backfill, unless approved in writing by the Consultant.

.15 After a period has passed adequate to reveal any settlement fill all depressions to correct grade level with appropriate material, machine compacted. Pay all costs required to make good all damage caused by settlement.

.16 Store and dispose of excavated materials as follows:

During the progress of the contract place the material as directed in such a manner that a minimum of damage or disfigurement of the existing ground will result and the material will not in any way impede the progress of the work. Dispose of surplus material as directed by the Consultant.

Place surplus topsoil separately from subsoil. Leave the site clear and unencumbered.

Protect, brace, support as required existing pipes, ducts, cables, etc. encountered in the work.

Do not disturb or interrupt the operation of any services without written approval from the Consultant.

3.12 Concrete Encased Duct Banks (26 05 00)

.1 Provide PVC duct runs consisting of parallel ducts encased in concrete as indicated on drawings.

.2 Ducts and concrete encasement for Power Supply Authority service cables shall conform to their standards and requirements.

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- .3 Place and set all ducts and accessories and supervise to ensure integrity of complete installation.
- .4 Conform to the requirements of the latest editions of CSA 22.2 No. 211.1, Rigid Types EB1 and DB2/ES2 PVC Conduit.
- .5 Join ducts together with an approved coupling to provide a sound and watertight joint. Stagger joints in adjacent ducts by not less than 200 mm (8"). Where PVC and bell fittings are used make connections to duct with an approved PVC solvent.
- .6 Install ducts with spacing of not less than 190 mm centre to centre both horizontally and vertically. Use only plastic or masonry spacers. Provide two (2) spacers minimum per 3000 mm (120") length of duct.
- .7 Grade ducts not less than 75 mm (3") per 30 m (100') for drainage and provide drainage facilities as detailed.
- .8 Encase ducts with 3000 pound concrete with a minimum cover of 75 mm (3") on all sides using pea gravel aggregate. Work concrete below and between ducts to produce a homogeneous mass. Provide reinforcing steel. Anchor all ducts in place in such a manner as to ensure that there is no movement during the placing of concrete.
- .9 Immediately after concrete has been placed test each duct with a mandrel not less than 300 mm (12") long and having a diameter 7 mm (1/4") less than the diameter of the duct. After all obstructions have been cleared pull a stiff bristle brush through each duct to remove all sand and other foreign material. Install a 225 kilogram (500 lb) test rope or other equivalent non-metallic cord in each duct and seal all ends with standard plastic duct plugs.

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.10 Provide end bell fittings at duct bank finished end face.

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Lighting

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PART 1. GENERAL

1.1 Submittals (26 50 00)

- .1 Include fixture catalogue data sheets with shop drawings. Arrange the fixture catalogue data sheets and identify in the same sequence as the specified fixture list. Fixture catalogue data sheets shall indicate the following:

Dimensions, weight, material, finish and mounting details.

Performance: Candle power distribution curves in two planes, C.V. chart of indoor fixtures and lumen output chart of outdoor fixtures and flood lights.

Pole wind loading, weight, dimension, anchoring details and finish.

Lamps: type and base, burning hours, CRI, CCT and lumens.

Drivers/Ballasts: type, wiring diagram, watts, voltage, P.F., sound rating, starting temperature, efficiency and other required characteristics.

- .2 Submit photometric calculation (electronic lighting level calculation analysis) to Owner and Electrical Consultant if requested during the shop drawings review process and for all alternates.
- .3 Submit color/finish chart for all lighting fixtures for final selection/approval.

2.1 Referenced Codes & Standards (26 50 00)

- .1 Comply with all requirements of the latest edition of CSA Standards.
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PART 2. PRODUCTS

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2.1 Light Sources (26 50 00)

.1 All luminaires shall utilize LED light sources

.1 Minimum lamp life of 50,000 burning hours.

.2 3000°K CCT to 3500°K for indoor application. 4000°K CCT for outdoor application unless otherwise noted.

.3 Minimum CRI: 80 (90 where indicated).

.4 LED modules shall be replaceable or supported by manufacturer warranty for minimum five (5) years.

.5 No mercury content permitted.

2.2 LED Drivers (26 50 00)

.1 Drivers shall be integral to the luminaire unless otherwise noted.

.2 Input voltage: 120–347V unless otherwise indicated.

.3 Power factor: Minimum 0.90.

.4 Driver shall be rated for minimum 50,000 hours at 40°C ambient.

.5 Driver shall be compatible with specified lighting control system.

.6 Dimming drivers shall be 0–10V, DALI, or digital protocol as indicated on drawings.

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.7 Drivers shall be Class 2 where applicable.

2.3 Luminaires (26 50 00)

- .1 Luminaires shall be CSA certified and complete with LED modules, drivers, and all required accessories.
- .2 Housing construction: Minimum 20-gauge steel or extruded aluminum unless otherwise noted. Designed to prevent sagging under suspension methods indicated.
- .3 Finish: Factory applied baked enamel or powder coat finish. Reflectance minimum 85% for reflector surfaces.
- .4 Thermal management: Luminaires shall incorporate integral heat dissipation designed to maintain LED junction temperature within manufacturer's rated limits.
- .5 Provide integral safety disconnect where required by code.
- .6 Lenses: UV-stabilized acrylic or polycarbonate, minimum 3 mm thickness unless otherwise specified.
- .7 Luminaires shall be field-replaceable or modular where applicable.
- .8 Exterior luminaires shall be Dark Sky compliant where applicable.
- .9 Luminaires shall carry a minimum five (5) year warranty.

2.4 Lighting Control (26 50 00)

- .1 Comply with the requirements of the latest edition of the follows:
 - .1 CSA-C22.2 No. 55, Special Use Switches.
 - .2 CSA-C22.2 No. 177, Clock-Operated Switches.
- .2 Time switches

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- .1 Time switches shall be complete with reserve power feature, omitting devices, manual operation, self-starting synchronous timing motor and sprinkler-proof enclosure.
- .2 Contacts rated for system voltage as indicated on drawings.
- .3 Outdoor photocell controls
 - .1 Photo-electric controls shall be weatherproof, temperature compensated and shock and vibration resistant. Turn-on action shall be adjustable from 1.5 to 5.5fc. Turn-off is adjustable and approximately three (3) times turn-on.
 - .2 Photo-electric control delay of up to 2 minutes prevents false switching due to temporary flashes of light. Contacts shall be 120 volt, single pole and shall fail in 'ON' position.
 - .3 Photo-electric control shall be complete with B-Bracket for wall mount of the photo-electric control.
 - .4 For outdoor lighting control, BAS system and photo-electric controls shall be wired to control exterior lights on at dusk and off at the selected time.
 - .5 Mount exterior photo-electric control with photoelectric cell facing north up high. Adjust light level selector to site instruction.
- .4 Indoor photo-electric controls

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- .1 Ceiling mounted on 4' recessed back box. Turn-on action shall be adjustable from 10fc to 200fc, and with 30 seconds time delay. Turn-off action shall be the same setting with 3-15 minutes time delay.
- .2 Controls shall include sensor and power/control unit. Sensor shall have red LED indications. Control unit contact rating: 20A, 120VAC, or 347VAC.

PART 3. EXECUTION

3.1 Installation (26 50 00)

- .1 Install all fixtures in the standard manner for the type of fixture and in accordance with the manufacturer's instructions. Support all fixtures from structural members except that fixtures installed in suspended ceilings may be supported by the ceiling where the ceiling supports are reinforced to carry the weight of the fixtures. Co-ordinate with Division 9 and submit written confirmation to the requirements of the Inspection Authority.
- .2 In non-accessible ceilings wire with not less than 1220 mm AC90 or RW90 wire in flexible conduit to adjacent outlet boxes placed above finished ceiling within reach of the fixture openings.
- .3 In accessible ceilings wire with 1830 mm AC90 or RW90 wire in flexible conduit to adjacent outlet boxes.
- .4 Where fixtures are not installed in approved ceiling system, provide steel fixture studs, brackets and hangers. Where fixtures are hung on chain hangers, provide chain of closed link type capable of supporting ten times the fixture weight. Use U-bolts for chain ends; S-hooks are not acceptable.
- .5 Provide suitable trim for all fixtures installed in drywall ceiling or within lay in or snap in tiles.

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- .6 Provide I.C. frame/enclosure for all fixtures installed in insulated ceiling. Confirm the insulated ceiling areas with Architect. Provide fire rated boxes for all recessed fixture in fire rated ceiling area.
- .7 Provide plaster frames for all fixtures recessed in plaster ceilings. Have plaster frames installed under Division #9 and ensure that they are located correctly. Pay for all work associated with this work.
- .8 Protect fixtures from dirt and damage during construction and clean when the installation is completed. Replace fixtures showing marks or scratches due to handling or tool marks.
- .9 Align fixtures shown in continuous rows or broken lines so that all rows appear as straight lines. Crooked lines and misplaced fixtures will not be accepted.
- .10 Where luminaires are surface mounted on inverted T-bar ceilings, they shall be supported directly from the building structure. Where this is not possible due to presence of mechanical ducts or other obstruction, supply and install galvanized steel channel, Unistrut or equal, above the ceiling, securely attached to the structure and not from the suspension system for the ceiling, and fasten the luminaires to the channel with clamping nut, bolt, flat washers and lock washer to the satisfaction of the Consultant. Provide bolts at least every 1.2m length of fixture (i.e., 3 bolts for 2.4m fixture).
- .11 Fixtures are shown on the electrical drawings in approximate locations only. Install fixtures in accordance with reflected ceiling plans, details and/or field instructions issued by the Engineer.
- .12 Install lighting fixtures in service areas, unfinished areas, mechanical and electrical rooms after the mechanical and electrical equipment is in place. Locate fixtures on site to clear all obstructions to the approval of the Consultant. Provide auxiliary steel members for hanging fixtures below ducts and other equipment. Where ceiling height is more than 3 meters, suspend ceiling surface mounted fixtures at 3 meters AFF. Where ceiling height is more than 3 meters, suspend ceiling surface mounted fixtures at 3 meters AFF.
- .13 Provide all mounting hardware for all fixtures.

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- .14 Check the latest ceiling finishes in all areas where recessed fixtures are specified to ensure that fixtures are purchased with suitable ceiling trim for the particular ceiling finish. Replace fixtures which are sent to the site with wrong ceiling trim or flanges with fixtures having the correct trims, flanges, etc. as required without additional cost.
- .15 In stairs, provide fixture on every main and half landing level. Coordinate with Architectural drawings for number of landings.
- .16 Fixtures shall be installed in accordance with the reflected ceiling layouts with due consideration for mechanical diffusers, bulkheads, sprinkler heads, and other obstructions. Check Mechanical and Architectural drawings before roughing-in to avoid any possible conflict.
- .17 Fixtures connected to ground fault interrupter circuits shall have separate neutrals (common neutrals for 2 or 3 circuits are not acceptable).
- .18 Exterior wall mounted lighting fixtures shall be mounted on recessed boxes except where fixtures with integral outlet boxes are specified in which case the recessed outlet box is not required. Outlet boxes shall be firmly anchored to the wall.

END OF SECTION