

PROJECT MANUAL – VOLUME 2B

Electrical Specifications

Issued for Tender

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DIVISION 26 ELECTRICAL

26 05 00.15	Electrical Demolition	3
26 05 01	Electrical General Provisions	18
26 05 02	Electrical Testing	2
26 05 20	Wire and Box Connectors Up to 1000 V	2
26 05 21	Wires and Cables Up to 1000 V	4
26 05 28	Secondary Grounding	3
26 05 29	Fastenings and Supports	2
26 05 30	Wiring Methods	2
26 05 32	Outlet Boxes, Conduit Boxes and Fittings	3
26 05 34	Conduits, Conduit Fastenings and Fittings	4
26 05 53	Identification of Electrical Systems	2
26 05 73	Short Circuit System Coordination Arch Flash Hazard	6
26 09 14	Surge Protective Device	3
26 24 16	Panelboards Breaker Type	3
26 27 26	Wiring Devices	3
26 27 26.03	Occupancy Sensors	5
26 28 21	Moulded Case Circuit Breakers	2
26 28 23	Fused and Non-Fused Disconnect Switches up to 1000 V	2
26 50 00	Lighting	3
26 52 10	Unit Equipment for Emergency Lighting	2
26 53 00	Exit Signs	2
26 56 00	Exterior Lighting	1

27 00 00 COMMUNICATIONS

27 00 00	Communications General Information	12
27 05 00	Common Work Results for Communication Systems	8
27 25 00	Firestopping Communications	5

28 00 00 ELECTRONIC SAFETY AND SECURITY

28 13 00	Access Control	2
28 23 00	Video Surveillance	2
28 31 00	Fire Alarm System	1

1 General

1.01 SUMMARY

- .1 This section describes the demolition of electrical systems, individual components and devices, as well as restorative measures.

1.02 RELATED REQUIREMENTS

- .1 Common Work Results For Electrical Section 26 05 00

1.03 COORDINATION

- .1 The contract documents do not indicate electrical work required to accommodate mechanical and architectural requirements. Electrical Contractor shall examine all mechanical and architectural contract documents for removal and reinstallation of ceiling and wall components to facilitate the installation of mechanical components.

1.04 SELECTIVE DEMOLITION

- .1 The following items shall be salvaged from the project and be turned over to the Owner in good condition: Refer to drawings.

1.05 SEQUENCING

- .1 The project will be constructed in phases. Contractor is to familiarize himself with the phasing of the project as indicated in the architectural contract documents.

1.06 STORAGE AND HANDLING

- .1 The Contractor will be fully responsible for assessing the condition of all components, systems and devices, which are to be removed from the project and subsequently reinstalled at a later date. Should any damage be noted, the Contractor shall inform the Consultant immediately. Failure to do so will result in replacement of any damaged or non-functional equipment by the Contractor at his own cost at the completion of the project.

1.07 TEMPORARY POWER

- .1 Provide temporary power to maintain existing services in operation at all times.

1.08 ELECTRICAL PANEL SCHEDULE

- .1 Update and replace all electrical panel schedules with new typed panel schedules. Submit updated panel schedules as part of close out documentation.
- .2 All breakers that are "SPARE" shall be places in the "OFF" position. Confirm "SPARE" status prior to prcoceeding with work.

2 Products

2.01 NOT USED

3 Execution

3.01 TIMING OF WORK

- .1 Work involving alterations, connections to or extensions of the existing power distribution, fire alarm, telephone, security, etc. to be carried out in such a manner to keep interruptions of service to existing systems to a minimum. Contractor to allow necessary overtime work to accomplish changeovers and reconnections at a time when existing building is at a minimum of use.
- .2 Contractor to provide a comprehensive schedule and detailed written confirmation of procedures for review by the Consultant. Identify outage times and durations for each service outage. Outages to be scheduled at Owner's convenience. No disconnection or isolation of services is to take place without 120 hours notice and approval of the Owner.
- .3 If required to maintain services to certain areas or keep outages to an acceptable minimum, make such temporary connections and provide such temporary facilities as are required to accomplish this.
- .4 Contractor to allow in bid price for temporary power, premium and overtime charges as required to accommodate conditions as outlined in the preceding paragraphs and specifically addressed in various sections of the specifications.
- .5 The adjacent existing facility's functions are to proceed uninterrupted during the course of Work on this Contract. Coordinate schedule or work with the owner's representative before work begins.
- .6 The contractor shall make suitable arrangements with the owner's representative for access to the work as appropriate.
- .7 Certain construction activities that generate noise vibration or dust may have to be temporarily halted during critical functions at the existing Facility. Coordinate and schedule such activities in advance with the Construction Manager.

3.02 DEMOLITION

- .1 The drawings do not show all electrical conduit, wiring, or devices to be demolished and removed. Drawings indicate only major equipment and/or devices. The Contractor is to carefully examine the site and existing Record Drawings where available to ascertain existing conditions.
- .2 Contractor is to remove all redundant and abandoned conduits back to source. Where conduits originate or terminate in the work area but continue beyond the boundaries of the Work, remove those conduits where located in accessible ceiling spaces, unless otherwise noted on the drawing.
- .3 Contractor is to remove all abandoned cabling and wiring back to source. Existing wiring and cabling is not to be reused. Unless specification noted on the drawings.
- .4 Do not disconnect any electrical services without the express permission of the Owner.
- .5 During demolition work, ensure that all products of combustion devices are removed or covered up to avoid nuisance alarms.

3.03 RESTORATION OF SERVICES

- .1 The drawings indicate known permanent or temporary reconnection of services only.

- .2 Where removal of existing conduit, wiring and/or devices affects devices not removed, altered or relocated under this contract, Contractor is to restore service to these devices in a permanent manner utilizing methods specified in other sections of these specifications. Where necessary, walls are to be opened up to allow the installation of conduits for new interconnection of devices or homeruns as required. Coordinate all such work.
- .3 Avoid coring and drilling of floors at all cost. Should it be necessary to penetrate floors, allow for x-ray examination of floor slabs to determine the exact location of all conduits and re-bar. Co-ordinate core drilling locations with the architect and architectural plans.
- .4 Verify all products of combustion detectors in accordance with the manufacturer's instruction upon completion of the project.

END OF SECTION 26 05 00.15

1 GENERAL

1.01 REFERENCE

- .1 Read and be governed by Definitions, Conditions of the Contract and its amendments, and supplements including General Conditions of the Contract and supplementary General Conditions.
- .2 Section 26 05 01 forms an integral part of the scope of work for the Electrical Contractor and will be referenced until completion of the Contract.
- .3 Throughout these specifications and the associated Electrical Documents, the following references must be applied:
 - .1 The term "By Others" noted within the Electrical Documents must mean work to be provided by the Managing Contractor or Owner's Project Administration Team. However, within his Price, the Electrical Contractor must allocate the associated costs to assist in coordination, some field manpower, and offer his expertise as an electrician to professionally execute the work. The final state of the work must ensure it benefits the Owner's Project Administration Team, Architect's vision, and the overall good for the Project.
 - .2 The term "Electrical Contractor" or "Contractor" must be used within drawings and specifications. Read this to mean the Electrical Contractor's scope of work.
- .4 Terms "Provide", "Supply", and "Installed" must be governed by the definition outlined within the Conditions of the Contract.

1.02 INTENT

- .1 The Electrical Contractor must include within his Price all field and office administration labor, equipment, and equipment incidentals in order to provide and execute the complete work, as specified within the Electrical Documents.
- .2 The Supplementary Form must be completed in full and submitted with the Price. The Consultant must advise the Prime Consultant and Owner's Project Administration Team of his review of the forms.
- .3 This Project and its documentation demand a significant amount of the Electrical Contractor's office administration manpower more than what he may be accustomed to. Therefore, the Electrical Contractor must ensure all associated administration costs are carried within his Price. In addition to his Project administration duties, the Electrical Contractor must be responsible to provide the following:
 - .1 Provide detailed conduit routing drawings and identify conduit system types and sizes, etc.;
 - .2 Provide assistance and information in the preparation of interference drawings;
 - .3 Provide electronic files to the Consultants for all milestone submissions c/w with full size set(s) of white prints;
 - .4 Provide final electronic files and white prints of record ("As-Built") drawings to both the Consultant and Owner's Project Administration Team;
 - .5 Provide as-noted completed mock-ups, sample boards, material samples, etc., well in advance of the construction schedule for review by the prime Consultant;
 - .6 Provide and submit to the Consultants fully compliant and reviewed shop drawings. Failure to execute this process must be the Electrical Contractor's responsibility for any scheduling impacts if the submissions are rejected during the review process.

1.03 LETTER AWARD OF CONTRACT

- .1 Prior to issuance of the Letter Award of Contract to the Electrical Contractor, the Owner's Project Administration Team reserves the right to interview and meet with the Electrical Contractor. The purpose of the meeting is to discuss with the Electrical Contractor and to ensure he has a full understanding of the Project and its deliverables.
- .2 With his Price submission, this Electrical Contractor agrees that, upon receipt of Letter Award of Contract, he will provide the following within five (5) working days:
 - .1 Provide all signed purchase orders for the entire scope of work to the Owner's Project Administration Team and the Prime Consultant;
 - .2 Provide a detailed shop drawing schedule complete with equipment long lead delivery dates; the schedule must list the manufacturers as noted on the Bid Form. The schedule must be submitted to the Owner's Project Administration Team and the Prime Consultant;
 - .3 The Electrical Contractor must confirm, in writing, to the Owner's Project Administration Team that his distributors can execute the scope of work and meet the schedule;
 - .4 The Electrical Contractor must submit the manufacturers' letter of confirmation that all documents have been reviewed and comply with or exceed the specifications.

1.04 MONTHLY DRAWS

- .1 Provide a sample of the Project's monthly progress draw for review and acceptance. A detailed draw is expected, for example:
 - .1 Distribution Equipment:
 - .1 Conduit Rough-in (6.25% of Total Value).
 - .2 Feeders Installed (6.25%).
 - .3 Equipment Supplied to Site (12.5%).
 - .4 Equipment Installed (24%).
 - .5 Equipment Energized (6.25%).
 - .6 Equipment Commissioned (6.25%).
 - .7 Equipment Test Reports Submitted (12.5%).
 - .8 Equipment Spare Parts Submitted (18.75%).
 - .2 The above samples must also be applied to, but not limited to, the following:
 - .1 Lighting;
 - .2 Telecommunications;
 - .3 Security;
 - .4 Fire Alarm;
 - .5 Branch Circuit Power;
 - .6 Distribution Equipment;
 - .7 Power Distribution and Services;
 - .8 Nurse Call Systems;
 - .9 Security System;
 - .10 Miscellaneous Systems (i.e. AV).
- .2 Provide a sample change notice breakdown for review and acceptance.
 - .1 Sample must include Conduit Prices, Unit Prices noted in BID FORMS, etc.
 - .2 Labor rates for all associated incidentals.
- .3 Project Co must be responsible to ensure all schedules, purchase orders, list(s), etc., have been submitted and that his schedules are updated accordingly prior to submission to the Prime Consultant and Owner's Project Manager Team.

1.05 CONTRACT DRAWINGS AND SPECIFICATIONS

- .1 Wherever differences occur between drawings, riser diagrams, or schematics, or between specifications and drawings, the maximum condition must govern and must be carried within the Price.
- .2 Bring discrepancies between drawings and actual field conditions promptly to the attention of the Prime Consultant for clarification.
- .3 Electrical Contractor must make onsite field verifications of dimensions noted on drawings since actual locations, distances, and levels must be governed by actual field conditions.
- .4 As the work progresses and before installing any apparatuses, equipment, fixtures, or devices which may interfere with the treatment and use of the building, obtain from the Prime Consultant a drawing or instruction for the location of the electrical equipment.
- .5 Install all conduits, wireways, etc., to conserve headroom and keep any interference to a minimum with the free use of the space through which they pass.
- .6 Install conduits, wireways, etc., only after the locations have been fully coordinated with all other trades by submitting electronic interference and conduit routing drawings.
- .7 Take special care in the installation of conduits, wireways, etc., which are to be concealed to ensure that they come within the finished lines of floors, walls, and ceilings.
- .8 Where such conduits, wireways, etc., have been installed in a manner as to cause interference, the Electrical Contractor must remove and reinstall them in suitable locations without extra cost to the Owner.
- .9 Do not remove or damage any structural fireproofing. Leave space to permit the fireproofing to be inspected and/or repaired.
- .10 Before commencing work, verify all grade and invert elevations, levels, dimensions etc., to ensure proper and correct installation of the work.
- .11 In addition to the electrical scope of work identified within these documents, provide the items as required by the Authorities Having Jurisdiction.
- .12 Install ceiling-mounted components (luminaires, speakers, etc.) in accordance with the architectural reflected ceiling drawings.
- .13 The electrical devices noted within the drawings must not be dimensioned, as drawings only identify the quantity of devices, luminaires, equipment, etc. The Electrical Contractor must reference the Architectural Drawings.
- .14 Coordinate with all trades and provide interference drawings prior to any installation of work. Revise locations, routing of conduits, etc., to avoid conflict without extra cost to the Owner.

1.06 ELECTRICAL CONTRACTOR'S SHOP

- .1 Provide a job site office, workshop, tools, scaffolds, material storage, etc., as required to complete the work of this Contract and as directed by the Consultant/Project Co.
- .2 The Electrical Contractor's office should, as a minimum, have the following capabilities: high speed Internet connection, complete with a spare port and patch cable, so that the Consultant can access the Internet to deal with and expedite Project related issues.

1.07 CLEANING

- .1 The Electrical Contractor must:
 - .1 Protect and clearly identify all equipment, including the equipment installed during the rough-in stage of construction. Note failure to identify the rough-in equipment will affect progress draw submission as the Inspecting Consultant cannot quantify the submission.
 - .2 During the performance of the work and on its completion, remove from the site and premises all debris, rubbish, and waste materials caused by the work for this Contract. Remove all tools and surplus materials after completion and acceptance of the work.
 - .3 Vacuum all equipment thoroughly at the time of final acceptance and of the work. Clean plastic components and exposed components of luminaires.
 - .4 All equipment must be professionally cleaned prior to turn over.

1.08 TEMPORARY SERVICES

- .1 Refer to General Contract Conditions.

1.09 PHASING / STAGING CONCEPT

- .1 The overall electrical phasing must be in concert and support the Project's Phasing Plan.
- .2 With respect to scheduling, the Electrical Contractor must meet all requirements identified in the Contract Documents.
- .3 It is imperative that the Electrical Contractor, prior to his Price Submission, fully understands the Owner's Project Administration Team's and Project Co's phasing plan as it relates to the existing systems operation, interconnections, and the installation of new power and communication systems.
- .4 All system shutdowns and interruptions must be coordinated with the Owner and the Consultants. The Facility's operation is the primary concern and will be the guiding principle in the coordination of shutdowns.
- .5 Coordinate the completed areas to be turned over to the Owner's Project Administration Team in a manner consistent with the phasing approach for this Project.
- .6 At each turnover, meet requirements as reflected in the Electrical Specifications.
- .7 Carry all associated costs and labor in the Electrical Price with respect to phasing and phased turn-over areas, as multiple testing system verifications will be required, for example, multiple fire alarm tests, etc.

1.10 SCHEDULING OF WORK

- .1 For all work to be performed under this Contract, adhere to the Construction Schedule detailed in the Contract Documents.
- .2 Contain all work being performed within the physical area of work which is underway during any particular period of time. Keep the amount of disruption in the existing facility to a minimum.
- .3 The Electrical Contractor must forecast and schedule his execution of the Electrical Scope of Work requirements well in advance so as to identify any conflicts. Requiring an immediate response from the Consultant due to poor planning will not be acceptable nor must the Consultant's response time be initiated as a reason to delay of any milestones.

- .4 Coordinate with the Commissioning Agent for schedule of Electrical Commissioning to ensure that the work must be complete prior to the Owner's occupancy.
- .5 Should the work within a particular area cause any electrical apparatus in another area to cease to function properly, modify and reconnect this apparatus which has ceased to function properly. The Electrical Contractor must notify all parties prior to modifications.

1.11 INSTALLATION OF WORK

- .1 The Electrical Contractor must be responsible for:
 - .1 The layout of the work of this Contract and for any damage caused to Owner's equipment by this installation, or other Contracts, by improper location or carrying out of this work.
 - .2 The prompt installation of the work of this Contract in advance of concrete pouring or similar work.
 - .3 The protection of finished and unfinished work and equipment and work of other Contracts from damage due to the carrying out of the work of this Contract.
 - .4 The condition of all material and equipment supplied under this Contract and for the protection and maintenance of work completed throughout the construction period.
- .2 Confer with other trades engaged on the Project, arrange the work so that it will be carried out in the best interest of the Project.
- .3 Provide items to be "built-in" in ample time and give any necessary information and assistance in connection with the building of the same.
- .4 Notify the Prime and Structural Consultants of the size and location of recesses, openings, and chases before floors, walls, etc., are erected. Submit electronic and a hard copy set of conduit drawings prior to any concrete pours and identify where openings in slabs or sleeves are required.
- .5 Proceed with the work as quickly as practically so that construction may be completed as soon as possible and in accordance with the Project Schedule.
- .6 Ensure that all equipment and material are ordered in time to meet the Construction Schedule. The Electrical Contractor must provide a schedule of equipment deliveries to the Prime Consultant after award of Contract. Coordinate equipment deliveries in such way that it will be delivered and in place prior to closing of the building/slab. Areaways are not designed for bringing equipment in. It is the responsibility of the Electrical Contractor to coordinate this requirement.
- .7 Provide promptly information required for the Construction Schedule.
- .8 Manufactured products supplied with instructions for their use must be used in strict accordance with those instructions.
- .9 Plug and cap all conduits until they are ready for pulling wires and making connections. Duct tape will not be acceptable, plastic conduit plugs or clasps must be used. Ensure caps are labelled for visual inspection. Cover and protect all fixtures and equipment against dirt, water, chemicals, or mechanical injury. Re-touch, refinish, or replace any equipment or materials damaged in shipment or during the construction prior to final acceptance at no cost to the Owner.
- .10 Where boxes embedded in concrete or installed in areas that the finished panels/materials must be applied, extension rings and/or custom boxes must be provided to ensure that there must be no gap between the boxes and the outlets. These conditions must apply to most but not limited to outdoor applications offices. Examine Architectural Drawings for other areas and include costs in Price.

- .11 Provide required materials for conduit crossings at expansion joints, both surface and recess type.

1.12 CODES, PERMITS, FEES, AND INSPECTION

- .1 All work must meet or exceed the latest requirements of the Ontario Electrical Code, its Supplements and local inspection bulletins.
- .2 Obtain all permits and arrange for inspection of all work and pay all fees in this regard. On completion of work, deliver the final unconditional "Certificate of Approval of the Authority Having Jurisdiction" to the Prime Consultant. Inspection fees are the responsibility of the Electrical Contractor. Multiple inspections and fees must be carried in the Price to allow the Owner's Project Administration Team to move in sequentially.
- .3 It is hereby agreed that all requirements have been examined and verified with the Electrical Safety Authority and a complete installation must be in accordance with these requirements which will be provided in the Price Submission.
- .4 The Electrical Contractor must keep a permanent record of each inspection made by the Electrical Safety Authority showing the dates, inspector's name, scope of the inspection, and statement of special decisions or permissions granted. Make these records available to the Consultants at any time and turn them over after completion of the work. Electrical Contractor must have them included in the manuals.
- .5 Comply with CSA Certification Standards and Electrical Bulletins applicable at time of tender and at time of tender submission.
- .6 CSA Z32-09 – Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.13 MANUFACTURERS' AND CSA LABELS

- .1 Must be visible and legible after equipment is installed.

1.14 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety. Follow all requirements of the Utility, Authority Having Jurisdiction, and Owner's Health and Safety Regulations.

1.15 MATERIALS

- .1 Refer to Project Documents and as specified herein.
- .2 Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type, or catalogue number, such designation is to establish the standards of desired quality, style, or dimensions and must be the basis of the Price. Provide materials so specified under this Contract unless changed by mutual agreement. Where two (2) or more designations are listed, the Electrical Contractor must choose one (1) of those listed and state the choice made in Supplementary Form, "Equipment and Material List".
- .3 Where the use of equivalent, alternate, or substitute equipment alters the design or space requirements indicated on drawings, the Electrical Contractor must include all items of costs for the revised design and construction, including the cost of all other trades and the Consultant's time involved to review the alteration.

- .4 Acceptance of proposed equivalents, alternates, or substitutions must be subject to the review by the Consultants and Owner and, if requested, the Electrical Contractor must submit for inspection, samples of both the specified and the proposed alternate items.
- .5 In all cases where the use of equivalents, alternates, or substitutions is permitted, the Electrical Contractor must bear the extra costs, including the Consultant's and Owner's time, on a time and material basis of evaluating the quality of materials and the equipment to be installed.

1.16 EQUIVALENTS AND ALTERNATES

- .1 Unless requests for changes in the Specifications are received, the Electrical Contractor will be held responsible to provide all specified items under his Price. After the Contract is awarded, changes in Specifications will be made only as defined in "Section - Material Substitutions."
- .2 For the equipment to be supplied by the Electrical Contractor, choices may be offered as alternates to the items named in the Specifications, in the space provided in the Form. Alternate proposals must be accompanied by full descriptive and technical data on the article proposed, together with a statement of the amount of addition or deduction from the Price if the alternate is accepted. Prior review by the Consultant is not required on items submitted as Alternate Price, but the decision on acceptance of the alternate(s) will rest with the Consultant and the Owner.
- .3 The Electrical Contractor must replace unspecified or rejected materials built into the work with specified or accepted materials at no additional cost to the Project.

1.17 MATERIAL SUBSTITUTION

- .1 After execution of the Contract, requests for substitution of materials or makes other than those specifically named in the Contract Documents may be considered by the Consultant and the Owner, subject to the following:
 - .1 The specified material cannot be delivered to the job in time to complete the work in proper sequence to work of other trades, due to conditions beyond the control of the Electrical Contractor. Refer to shop drawing submission section;
 - .2 Requests for substitutions must be accompanied by documentary proof of equality, difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment. Blanket statements will not be accepted;
 - .3 In case of difference in price, the Owner must receive all benefits of the difference in cost involved for any substitution and the Contract altered by a change order to credit the Owner with all savings obtained;
 - .4 Materials and equipment substituted or offered as alternatives must have spare parts and servicing available and must fit into the space allocation shown on drawings;
 - .5 If any material or equipment being considered for substitution involves additional design, architectural or engineering fees or other costs in confirming whether or not the substitute material or equipment is suitable for the Project, such fees or costs must be paid by the Electrical Contractor. The Consultant's per diem rate must be supplied for each piece of device or equipment requested for review. There is no guarantee that the reviewed product must be approved by the Owner's Project Administration Team and/or reviewing Consultant.

1.18 SHOP DRAWINGS

- .1 Submit shop drawings in accordance to the Electrical Specification and Contract Documents.
- .2 After award of the Contract, the Electrical Contractor must provide a detailed schedule for shop drawing submissions and a schedule for the delivery of the equipment to the site. The Electrical Contractor must identify any equipment whose delivery time will negatively impact the Project completion date. Failure to do so will require the Electrical Contractor to provide temporary equipment, if approved, until the specified equipment is available. No extra costs must be paid to the Electrical Contractor for the above.
- .3 Shop drawings must be complete with dimensions, weight (self and operating), recommended housekeeping pad dimensions, inertia pads, etc., so that it can be reviewed by Structural and other applicable Consultants, etc.
- .4 Prior to detailing reinforcement, the Electrical Contractor must submit drawings of the structure showing formed holes, recesses, and sleeving required under all sections. The submission must be complete with dimensioned openings, recesses, and sleeves, and relate to suitable grid lines and elevation.
- .5 With his Shop Drawing Submission Schedule, the Electrical Contractor must make a Priority List for the Consultant's review. If not identified, the Consultant will review shop drawings at his discretion if all submitted at once.
- .6 Submission of shop drawings must be made in an organized manner corresponding with the Construction Schedule.
- .7 It is the Electrical Contractor's responsibility to fully review and seal his shop drawings prior to issuance to the Consultants.
- .8 The Consultant must not be held responsible for rejected shop drawings as it relates to the Construction Schedule.
- .9 The Electrical Consultant will review and process shop drawings within ten (10) working days of his receipt, for each individual item, not when the Electrical Contractor submitted them. 10-day period will not be revised regardless of the time frame noted anywhere in the Project's Contract Documents.

1.19 SAMPLES

- .1 Submit samples of electrical equipment, colors of equipment, etc., for review by the Prime Consultant, as specified. Samples must remain onsite until completion of the Project. Final fabrication of equipment must only occur until the Prime Consultant's selection. The Electrical Contractor must identify the response time required, as a minimum allow for two (2) weeks.

1.20 ELECTRONIC RECORD DRAWINGS

- .1 The Consultant will provide to the Electrical Contractor(s) one set of electronic drawings (.pdf) based on Project's Delivery Program Version, for the purpose of preparing interference conduit routing drawings. As the job progresses, mark up white prints to accurately indicate installed work, i.e. location and elevations, etc. On completion of the work, transfer the information neatly onto the electronic files, based on Similar Program Version, and submit the soft copy (.pdf) and one set of prints for review. Correct the soft copy (.pdf) as directed and hand these over to the Consultant, together with a set of white prints, on completion. Complete all computer schedules as deemed necessary.

- .2 The Electrical Contractor must record, as the job progresses, all approved changes and deviations made to any work shown on the original Contract Drawings whether by addenda, requested changes, job instructions, and changes due to Project conditions.
- .3 The Electrical Contractor must indicate on the drawings all buried services and their elevations, pull boxes, junction boxes, empty conduits, concealed main and sub-feeder conduits, and any other equipment not clearly in view, with exact dimensions for future reference. Tie dimensions by measurement to existing topographical features and include changes in directions as well as at least three (3) points on straight runs of conduits, etc. Include photographs c/w reference points on drawings.
- .4 Record drawings must be kept up to date and be available for checking at any time by the Consultant. Failure to produce drawings may cause the reduction to requested monthly Progress Draws. In addition, the Electrical Contractor will provide updated record drawings as noted in the Contract Documents. Minimum two (2) copies, one for Electrical Consultant, and one for Owner's Project Administration Team. Each submission must be clearly identified.
- .5 Final Record Drawings must be submitted four (4) weeks prior to the requested date of substantial completion.
- .6 The Electrical Contractor must present all data reports directly on the Electrical Record Set Drawings by scanning selected portions of the electrical shop drawings into the set, preferably next to where the equipment is shown on drawings or as an additional data sheet having an additional "E" number drawing (The purpose of this is the creation of a fully integrated user-friendly document containing all vital data in a single package). This will include such reports as Panel Data, Circuit Numbering, Motor Control Centre Information, etc.

1.21 TEMPORARY AND TRIAL USAGE

- .1 After any part of the work of this Contract has been completed, the Electrical Contractor, Prime Consultant, Owner, and Consultants must realize inspections together. The Electrical Contractor must carry out performance tests of such parts under the direction of the Consultant. If deficiencies are found, he must rectify them immediately to the satisfaction of the Consultant and Owner. After such deficiencies are rectified, place the work in service. If, in placing a portion of the equipment in service, it is necessary to make temporary connections in the wiring to obtain proper operation, provide such connections in the manner required by the Consultant/Owner.
- .2 Temporary or trial usage of any electrical devices, machinery, apparatus, equipment, or materials will not be construed as evidence of the acceptance of same.
- .3 No claims for damages will be considered for injury to or the breaking of any parts of such work which may be used.

1.22 CONSULTANT'S INSTRUCTIONS

- .1 During construction, the Consultant will issue such individual instructions as may be necessary for verification and clarification of the work. These instructions must be binding as part of the Contract Documents. Each instruction must be individually numbered for tracking purposes, the number of instructions must not be considered as a poor reflection of the documents.

1.23 CHANGE NOTICES AND CHANGE DIRECTIVES

- .1 No additional amount over and above the Contract Price will be paid for extra work unless a written order signed by the Prime Consultant or Consultant for such work to proceed is given.
- .2 When change or additional work is required, the Consultant will issue a notice of contemplated change, together with revised drawings if necessary, identifying the additions, deletions, or alterations required.
- .3 When and if the change price is accepted, a change order will be issued by the Prime Consultant and then, and only then, may the work listed be carried out.
- .4 The Electrical Contractor's promptness in submitting his review is essential.
- .5 Change directives must be governed by the terms as outlined within the Contract Documents.
- .6 Electrical Contractor's equipment incidental costs and rental costs must be clearly identified within the Supplementary Form.
- .7 Upon receipt of the change the Electrical Contractor must provide, but not limited to, the following:
 - .1 Review the scope of work;
 - .2 Immediately determine, in writing, any impact to the Construction Schedule and issue it to the Prime Consultant and Owner's Project Administration Team for review.
- .8 Upon issuance of the change, the Electrical Contractor must provide the following:
 - .1 An immediate evaluation of these changes and submit the price to the Consultants;
 - .2 When and if the price is approved, a change order will be issued by the Prime Consultant and then, and only then, may the work listed be carried out. The Electrical Contractor's promptness in submitting is essential;
 - .3 Submit a complete breakdown of labor and material involved;
 - .4 Provide separate unit prices for each item of labor and material;
 - .5 All support documentation from the distributor;
 - .6 Submitting lump sum prices for extras and/or credits will not be accepted. Electrical Contractor must advise his distributor;
 - .7 Electrical Contractor must offer to the Owner the benefit of utilizing previously installed services, i.e. conduits large enough to accommodate additional wiring, etc., minimizing the change notice overall quote.
- .9 When the request for change is issued, the Electrical Contractor must examine the Scope of Work description and define the affected area. Do not progress the work in the affected areas until the changes are approved. If this process must delay the schedule, the Electrical Contractor must inform the Prime Consultant immediately for direction.
- .10 All purchase orders breakdowns must be submitted that will be applied to change notices. The purchase orders must include, but not limited to, the following:
 - .1 Submit all data in accordance to the General Contract Documents;
 - .2 Submit the cost and "locked-in rates" for each conduit size and types;
 - .3 Submit the cost and "locked-in rates" for each wire size and types;
 - .4 Cost for scaffolding, lifts, etc., and their associated rental rates. Scheduling must be reviewed at the time of the change notice sample submission with Owner's Project Administration Team;
 - .5 Cost for miscellaneous tools and must be clearly identify what "miscellaneous" is interpreted as.

1.24 REQUESTS FOR INFORMATION - RFI

- .1 The successful Electrical Contractor may submit, if he chooses, a Request for Information also known as an RFI to the Consultant(s) for clarification to an item within his scope of work.
- .2 It is understood that an RFI is a form of dialogue between the Contractor and Consultant(s).
- .3 The quantity of RFIs generated during the Project's construction is no reflection of the quality of the Electrical Documents nor must the quantity of RFIs form the basis of a delay claim.
- .4 In order to expedite the RFI response time, the RFI must be clearly identified and directed to the Consultant responsible for that work.
- .5 The RFI must be submitted to the Consultant(s) in a timely manner with a minimum of one (1) month look ahead for its related work. The Electrical Contractor must be responsible that the Construction Schedule is never impacted.
- .6 An RFI will not be accepted nor must it be submitted after 15:00 (EST) to the Consultant. If the RFI is submitted after the time specified, it must be then dated for the next working day.
- .7 The Electrical Contractor must never place the Consultant in a situation where, due to poor planning and issuance of the RFI requires an immediate response, putting a deliverable date is in jeopardy.
- .8 It is the Contractor's responsibility to direct the RFI to the respective Consultant for example, a slab core drilling request must be directed to the Structural Engineer, the Electrical and Prime Consultants must be copied.
- .9 The Electrical Contractor must avoid issuing an RFI with requesting clarification for multiple subjects. One item per RFI so as to expedite response times.
- .10 The Electrical Consultant reserves the right to process each RFI within five (5) working days. Issuance of the RFI must factor in the response time and the construction look ahead.
- .11 To assist the process, the Electrical Contractor must identify the level of priority for example, low, medium, or high.

1.25 VOLTAGE RATINGS

- .1 Provide operating voltages in accordance with latest CAN3-C235-83 Standard.
- .2 Motors, electrical heating, control, and distribution devices and equipment must operate satisfactorily at 60 Hz within the normal operating limits established by the above Standard. Equipment must operate in the extreme operating conditions established in the above Standard without damage to any equipment.

1.26 MOUNTING HEIGHTS

- .1 The mounting height of equipment is measured from the finished floor to the centerline of the equipment, unless specified or otherwise indicated. The Electrical Contractor must confirm mounting heights with the Architect prior to rough-in, unless code related.
- .2 Mounting height of wall receptacles in Owner spaces and corridors must be at a minimum of 200 mm to the underside of outlets. Electrical Contractor must coordinate outlet mounting heights with baseboards and Architectural layouts.

- .3 If the mounting height of any equipment is not indicated, verify the mounting height before proceeding with the installation.
- .4 Install electrical equipment at the following mounting heights, unless otherwise indicated:
 - .1 Local switches: 47 in. (1,200 mm);
 - .2 Wall receptacles:
 - .1 General: 12 in. (305 mm); Refer to Architectural Drawing for placement of device within block motor joints.
 - .2 Above top of continuous baseboard heater: 8 in. (200 mm);
 - .3 Above top of counters or backsplash: 8 in. (175 mm);
 - .4 In mechanical rooms: 47 in. (1,200 mm);
 - .5 For emergency lighting battery units: Adjacent to the battery unit;
 - .6 Outlets for institution equipment: 48 in. (1,200 mm), unless noted on Architectural Documents.
 - .7 For areas classified as hazardous locations, install all electrical devices as per Code requirements. Electrical Contractor must obtain a copy of the Code Report and coordinate with Architectural Drawings regarding such locations.
 - .3 Panelboards:
 - .1 72 in. (1,800 mm) to the top, except that the panelboard must not be lower than 6 in. (150 mm) above the finished floor;
 - .2 Where multiple panelboards are mounted together, align tops of all panelboards or trims with the highest panelboard determining the height.
 - .4 Telephone/data outlets: 12 in. (305 mm);
 - .5 Wall-mounted telephone outlets: 48 in. (1,200 mm); (i.e. pay phones);
 - .6 Emergency call outlets as per Owner's standards;
 - .7 Fire alarm stations: 47 in. (1,200 mm);
 - .8 Fire alarm speakers: 84 in. (2,300 mm) and in ceiling;
 - .9 Wall-mounted speakers: 84 in. (2,100 mm);
 - .10 Doorbell pushbuttons: 47 in. (1,200 mm);
 - .11 Emergency lighting battery units: 96 in. (2,400 mm);
 - .12 Wall-mounted dry type transformers: 96 in. (2400 mm) to the bottom;
 - .13 Individual starters:
 - .1 60 in. (1,500 mm) to the top;
 - .2 Where multiple starters are mounted together, align tops of all starters or trims with the highest starter determining the height.
 - .14 Splitters: 4 in. (100 mm) below the lowest equipment connected to the splitter.
 - .15 See relative Specifications for other system devices and/or drawings.

1.27 FIREPROOFING

- .1 Where cables or conduits pass through floors and fire-rated walls, fill space between wiring and sleeve and seal with 3M fire stopping system and details or equivalent. Contact the representative to ensure that the installation meets manufacturer's requirements.
- .2 Care must be taken to keep integrity of all assemblies. The Electrical Contractor must provide, at the end of the Project, a letter from manufacturer indicating that the installation meets the requirements and ratings.
- .3 Meet all requirements of the OBC and fireproofing requirements, as specified under the General Contract Documents.
- .4 Electrical Contractor must submit shop drawing samples and in accordance to shop drawing submission requirements.

1.28 BASE SUPPORTS

- .1 Where conduit and equipment are located on walls or slabs, which will not permit the support of equipment, provide suitable supports to the building structure. Supports must be constructed of steel members or of steel pipe and fittings designed to safely support the equipment.
- .2 All equipment bases must be set on pads of kinetic pre-compressed fiberglass or vibration isolators sized to suit the equipment which they ought to support.
- .3 Refer to acoustic requirements (available by Architect) for additional vibration isolators and requirements.
- .4 All hangers and connections to open web steel joists must be made at the panel points. It is not structurally acceptable to impose any loads on either the top or the bottom chord of the joist between panel points. Obtain the maximum working load that can be suspended from a joist panel point from the Structural Consultant prior to installation of any work and strictly adhere to these requirements. Loads must be applied so that they do not cause twisting of the joints.

1.29 INSERTS, SLEEVES, CURBS, AND OPENINGS

- .1 Provide all inserts, sleeves, curbs, and housekeeping pads required for the work of this Contract. All sleeved or formed openings through the structure must be shown on Sleeving Drawings which are to be submitted to all Consultants for review prior to construction. No holes through the structure will be permitted without written approval of The Prime and Structural Consultant.
- .2 Use only factory-made threaded or toggle type inserts as required for support and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- .3 Use factory made expansion shields where inserts cannot be placed, but only where approved by the Prime or Structural Consultant, and only for loads of 50 kg or less.
- .4 Do not use power activated tools.
- .5 Supply and locate all inserts, holes, anchor bolts, sleeves, and roof pitch pockets in time when walls, floors, and roof are erected.
- .6 Size sleeves to provide 1 in. (25 mm) clearance all around.
- .7 Use the following sleeving materials:
 - .1 Through all interior walls, use Schedule 40 steel pipes, machine cut, flush with finished structure. Verify Room Finish Schedules;
 - .2 Through all exterior walls above grade, use Schedule 40 steel pipes, machine cut, flush with finished structure inside, and to suit flashing on outside;
 - .3 Through all foundation walls below grade and all other waterproof walls, provide Link Seal type assembly. Verify flashing details for further information. Clamp manufactured by Thunderline or Innerlynx;
 - .4 Through all waterproof floors, washrooms, janitors' closets, boiler rooms, mechanical rooms, kitchen, and roofs, use wrought iron sleeves, machine cut. Extend sleeves 4 in. (100 mm) above finished floor upwards and cut flush with underside of floor.
- .8 Approved type plastic sleeves, conduit sleeves, or 18-gauge galvanized steel sleeves may be used as an alternative for Schedule 40 steel sleeves in interior areas.
- .9 Extra heavy weight cast-iron sleeves may be used as an alternative for wrought-iron sleeves.

- .10 Provide 4 in. (100 mm) high, 4 in. (100 mm) wide, watertight concrete curbs with 0.8 in. (20 mm) chamfered edges around all sleeves and conduits passing through floors.
- .11 Sleeves are not required in walls and dry area floors, where conduit is installed ahead of wall construction.
- .12 The Electrical Contractor must be responsible for packing all sleeves between the conduit or cable passing through the sleeve and the sleeve, and all spare sleeves with loose fiberglass insulation. Seal the annular space both sides as follows:
 - .1 For all horizontal sleeves in exposed areas, use a seal of equal or better fire rating than the wall to be sealed;
 - .2 For all horizontal concealed sleeves through fire walls and through walls separating areas of different air pressure, use a permanently resilient silicone base or equal sealing compound;
 - .3 For all vertical sleeves through roofs, washrooms, janitor closets, and equipment rooms, use permanently resilient silicone base or equal compound, non-flammable and waterproof. Ensure that seal is compatible with floor and ceiling finishes. Verify the Room Finish Schedules for further information;
 - .4 Provide proper fire stop materials for sleeves passing through fire-rated walls and/or assemblies.
- .13 Set and securely support sleeves, ties, anchor bolts, pipe hangers and other inserts, openings and sleeves, in concrete floors and walls, as required by all trades. Use setting diagrams, templates, and instructions provided by others for location and setting.
- .14 Advise Prime Consultant, without delay, of any openings, sleeves, inserts, and embedment required, but not shown on the Structural Drawings or on reviewed shop drawings.
- .15 Sleeves, openings, etc., within slabs and walls greater than 50 mm square not indicated on Structural Drawings, must be approved by the Consultant.
- .16 Do not provide for any openings or inserts within beams or columns without approval of the Structural Consultant.
- .17 Do not eliminate or displace reinforcement to accommodate hardware or water stops. If inserts cannot be located as specified, obtain approval of all proposed modifications from Structural and Prime Consultant before placing concrete.
- .18 Verify locations and sizes of sleeves, openings, etc., shown on Structural Drawings, with Architectural, Mechanical, and Contract Drawings.
- .19 Dissimilar embedded metals must be separated by a minimum of 40 mm of concrete or must be protected by electrically insulating coating or separators, for all concrete otherwise likely to be exposed to moisture. Stainless steel and plain steel must be considered dissimilar metals.
- .20 In slabs and ramps, metallic embedment, and inserts, such as conduits, junction and fixture boxes, and other hardware, must comply with CAN/CSA-S413.

1.30 ACCESS PANELS AND DOORS

- .1 Refer to assigned Section.

1.31 PAINTING AND STENCILING

- .1 All hangers, channels, conduits, etc., must be delivered to the site galvanized after fabrication and all metal cut and finishes damaged on the job must be painted to match.

- .2 All equipment and materials, panels, luminaires, etc., must be stored in a dry, clean location, covered if necessary, to preserve factory finish.
- .3 Where equipment and material are designated unfinished, all exposed metal work, except chromed locks and hardware, must be left with a suitable prime coat finish.
- .4 Painting of equipment and material requiring a finished coat after installation will be carried out under the condition of the Contract. This does not apply to the making good of damaged factory finishes which must be done by the Electrical Contractor.

1.32 IDENTIFICATION AND LABELLING

- .1 Clearly identify all conduit and Teck cable systems carrying feeder cables by painting the voltage of the system, feeder and circuit identification, and any other wording that may be required at regular intervals on the conduits, on all splicing and pull boxes, on both sides of sleeves and at each floor on vertical risers. The actual wording and size of the letters and spacing of each inscription must meet the requirements of Owner's Facility Manager and Consultant. Paint used must be durable and resistant to chipping. Failure to carry out task will affect Progress Draws.
- .2 Identify all electrical equipment in accordance with Contract Specifications.
- .3 In pull boxes, junction boxes and at terminations, feeders must be identified by plastic plates indicating system voltage and circuit designations, and individual conductors must be identified with colored tape or covering to show phase, neutral, or ground connection. The plates must be 1 in. (25 mm) in diameter and have letter stamped. 6 in. (15 mm) high, and the color coding must be Phase A - red, Phase B - black, Phase C - blue, Neutral - white, and Ground - green. All must be coordinated with Authorities Having Jurisdiction.
- .4 The outer covering of branch circuit wiring must be color coded throughout all 600, 347, 208 V, and 120 V systems: Phase A - Red, Phase B - Black, Phase C - Blue, Neutral - White, and Ground - Green. Identification must suit the local inspector prior to installation.
- .5 Electrical Contractor must paint the interior of all boxes (outlet, junction etc.) with a durable paint of a color which identifies the system function. Junction box cover plate must be painted as well. Once boxes and cover plates are dried, descriptions and/or circuit numbers will be identified. Failure will affect monthly progress draw requests. The applicable colors are as follows:

SYSTEM	COLOR
Lighting & Power - 120/208 V	Grey
Emergency - 120/208 V	Grey EM
UPS - 120/208 V	Grey UPS
Lighting and Power - 347/600 V	Orange
Emergency - 347/600 V	Orange EM
Fire Alarm	Red
Telephone	Green "T" on cover
Data	Green "C" on cover
Cable TV	Green "AVTV" on cover
Security	Yellow
Surveillance	Yellow
Public Address System	N/A
Low Voltage Switching	Black
Indicate all circuit numbers on box painted cover plates. Provide circuit numbers on all face plate receptacles and switches/dimmers. Submit sample for review.	

- .6 All high-, medium-, and low-voltage raceways must be labelled "DANGER 44 kV or 600 V, or 208 V", at 3-m intervals along raceway. Labels are to be white in _____ with black lettering. Submit sample prior to manufacturing. Refer to Nameplate Specification for additional requirements.
- .7 Each wall-mounted cover plates (for both switches/dimmers, receptacles, and electrical controls) must be security labeled and filled to indicate the physical locations of the outlet, its designation, and the circuit numbers it terminates. Font must be Bold Arial, ¼ in. for panel location and designation and 3/16 in. for circuit numbers. Electrical Contractor must coordinate and carry all associated costs or provided with a Lamicoid nameplate fastened to the cover plate.
- .8 The Electrical Contractor must submit all labelled cover plate samples to the Owner's Project Administration Team for approval prior to manufacturing.

1.33 NUMBER AND LOCATION OF OUTLETS

- .1 Provide outlets for light, power, and systems of the number and in locations shown on the drawings, if identified on Architectural Drawings, they must govern. Locate all outlets accurately with respect to building lines and in centering outlets due allowance must be made for overhead pipes, ducts, equipment, and for variations in wall or ceiling finishes, window trim, paneling, etc. When necessary, make adjustments to ensure that all outlets are properly centered. Install local lighting switches installed on the strike side of the door as finally set and accept responsibility for determining this before outlet boxes are installed. Refer to Architectural Documents for additional information. If not shown, Electrical Contractor must coordinate with Architect prior to rough-ins.
- .2 The location of any outlet may be changed without extra cost or credit providing that the new location is within 20 ft (6 m) of that originally shown on the drawings and that instructions for the revision is issued prior to installation of the outlet.
- .3 Do not mount outlet boxes in walls and partitions back-to-back and provide a minimum of 6 in. (150 mm) between boxes. Provide acoustic insulating medium in conduits which join boxes on opposite sides of same wall or partition, refer to Acoustic Documents and details for additional information.

1.34 BRANCH CIRCUIT WIRING

- .1 Lighting and power panels are specified as sequence bussed, unless noted, and all branch circuit wiring for these panels must be such that where a common neutral is used for two (2) or three (3) circuits, these circuits must be fed from adjacent breakers so that single-pole breakers may be replaced with 2 or 3-pole breakers should this be so required in the future. All circuits must be balanced. All wires, including neutrals and grounds, must be labelled at both ends (tagged and labeled).
- .2 For all outlets for computers and UPS circuits, provide a separate neutral for each circuit. Shared neutral is not acceptable. This requirement is not applicable to furniture power connections. Wires must be labelled at both ends. Electrical Contractor must provide a sample for review.
- .3 Separate neutral and grounds must be provided for all audio/visual circuits.

1.35 CONNECTORS AND TERMINALS

- .1 Wire connectors must be of an approved type:

- .1 Pre-insulated spring type consisting of coil of steel wire, hard steel shell, and flexible polyvinyl insulation with long skirt extended beyond the bell end of the spring.
- .2 Tinned, copper compression type installed using the manufacturer's recommended tools and dies, and with positive locking insulating cap.
- .2 Use compression type tinned copper terminals for all conductor terminations, except where bolted type terminals are supplied with equipment, such terminals to be of copper tinned overall.

1.36 MOTOR AND EQUIPMENT WIRING

- .1 Provide power wiring connection and fittings external to all motors, machines, starters, control panels, etc., supplied under this and all other Contracts, except as noted herein.
- .2 Power wiring will include, but not be limited to, all raceways, conduits, lugs, fittings, disconnect switches, auxiliary devices for 3-phase 600 V, and 3-phase 208 V motors and 1-phase 208 V, and 1-phase 120 V motors. All wiring motor to be in accordance with the manufacturer's specifications.
- .3 The use of "lock off stop" devices are not permitted. Provide isolation disconnect switches for all motors that are 9 m or greater away from the motor starter or if the distance is less, provide disconnect switches for the motors where the motor starter is not visible.
- .4 All 2-speed and delta wye motors must have an adequate number of properly sized feeders between the starters and motors to allow for operation. Note that all remote disconnect switches located adjacent to 2-speed motors and delta wye must be 6-pole with an auxiliary contact.
- .5 All motor 25 HP or larger must be complete with reduced voltage auto transformer starter, unless otherwise noted. This is applied when starters are provided by Electrical.
- .6 All motor starters, control wiring, etc., must comply with the Electrical Specifications.

1.37 CUTTING AND PATCHING

- .1 The Electrical Contractor must employ particular trades to do all required cutting, patching, and repairing of surfaces for his work.
- .2 Supporting members of any floor, wall, or the building structure must be cut only in such a location and manner as directed by the Consultant and the Structural Consultant.
- .3 All holes and surfaces must be repaired with the type of material removed by the tradesmen expert in the type of repair required.
- .4 Provide fire barriers around all components in holes which penetrate fire separations. The fire barrier medium provided must make the fire separation equal to or better than the medium which was cut away. All materials must be CSA approved and UL listed.
- .5 All floor saw-cutting and drilling required for electrical services must be performed within the hours approved by the Owner's Project Administration Team. Written notice must be given to the Owner's Project Administration Team.
- .6 All openings through concrete/blocks/stones/bricks must be core drilled. The area must be scanned/x-rayed prior to coring. No saw cutting/chipping will be allowed. Structural Engineer must be provided with drawings for proposed openings for approval. All costs must be carried by Electrical Contractor.

1.38 WARRANTY

- .1 Provide a 1-year unconditional guarantee on all labor and material from the date of acceptance of the Project under this Contract, except where warranties on certain items extend beyond one (1) year. In this case, the extended warranty must be honored.
- .2 If partial occupancy is required, the start date for the warranty must be negotiated.

1.39 INTERFERENCE DRAWINGS

- .1 The Electrical Contractor must identify a separate line item within the Progress Draw labelled as "Interference Drawings" at a minimum of 0.3% of Contract Value.
- .2 Interference drawings must be provided to make clear the work to be installed and/or to show how it may affect other trades.
- .3 Equipment dimensions must be based on dimensions noted on reviewed shop drawing.
- .4 All components shown on the interference drawings must be shown to scale.
- .5 For equipment substitutions, a complete interference set of drawings of the area affected by the revision must be provided.
- .6 Interference drawings must be provided showing both drawing and sections and must incorporate all services, including electrical conduits and over 1 in. (25 mm), electrical cable trays, fire alarm devices, and luminaires.
- .7 The Electrical Contractor must submit dimensioned sleeves drawings showing the location and dimension of sleeves through all floor structural walls and roofs for review by the Prime and Structural Consultants.
- .8 The Electrical Contractor must submit a plan layout showing all of pieces of equipment to be provided and the actual weights of the equipment for review as soon as possible after Contract Award.
- .9 Installation of the Electrical work must not proceed until interference drawings have been submitted to the Prime Consultant for his review. Construction Schedules must not be impacted.
- .10 If conflicts exist between trades and new or existing services, a proposed solution must be submitted for review by the Consultants.

1.40 CONDUIT DRAWINGS

- .1 Provide detailed conduit routing drawings for all systems.
- .2 Routing must identify surface, recessed, and below slab drawings.
- .3 In slab, routings must be submitted for Structural Consultant's review and acceptance.
- .4 Drawings must be prepared on the Project's delivery program and scaled for 1:100 and 1:50, etc.

END OF SECTION 26 05 01

1 GENERAL

1.01 GENERAL

- .1 Requirements of Division 01 - Quality Control are applying to work performed under this Section, except that the cost of this work is to be paid by this Section and not by the testing allowance.

1.02 REFERENCE STANDARDS

- .1 Reference Standard CSA Z32-15 - Electrical Safety and Essential Systems in Health Care Facilities.
- .2 Of particular interest to the electrician laying out wiring runs are the requirements of CSA Z32-15 Standard, Clause 5.4.2, which dictates that at a load equal to 80% of circuit ampacity (12-A for a 15-A circuit), the voltage drop from the branch circuit breaker to the receptacle must not exceed 3%. Even more noteworthy is the requirement of Clause 5.10 dictating that neutral to ground voltage under open circuit condition be less than 2 V and that under a test using a low-voltage supply between ground and neutral producing 80% of rated circuit ampacity (12-A for a 15-A circuit), the voltage rise must not be higher than 3 V for the total current path. Typically, this requires an impedance of 0.1Ω or less for the ground conductor. For most circuit wiring runs, the ground conductor will need to be sized considerably larger than the electrician may be accustomed to.

2 TESTS

2.01 PATIENT CARE AREA TESTING

- .1 All tests specified must be conducted on all branch and feeder circuits.
- .2 Tests must be performed by approved testing firms listed in this Section.
- .3 Tests must include (as described in CSA Z32-15 Clauses):
 - .1 Conductor insulation integrity (Megger) (Clause 5.3).
 - .2 Circuit breaker mechanical operation (Clause 5.5).
 - .3 Polarity for all receptacles (Clause 5.6.6.3).
 - .4 Voltage drop (Clause 5.4.3).
 - .5 Voltage difference between ground points (Clause 5.9.2).
 - .6 Ground return path voltage rise (Clause 5.10).
 - .7 Receptacle retentive force (Clause 5.6.6.1).
 - .8 Test of impedance to ground and hazard, index monitoring (for isolation systems only) (Clauses 5.11.2.1 to 5.11.2.5).
 - .9 Include all receptacles on articulating arms and headwall units in testing.
- .4 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .5 Measure phase voltage at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .6 Record phase and neutral currents on panelboards, dry-core transformers, and motor control centres, operating under normal load. State hour and date on which each load was measured and voltage at time of test.

2.02 PRE-SERVICE TESTING

- .1 The following tests must be made prior to putting the electrical equipment into service to ensure that the distribution equipment has been installed in a satisfactory manner and suitable for placing into service without endangering personnel or the system.
- .2 Include in Tender amount, all costs and fees incurred for this testing. No additional costs will be accepted by the Owner.
- .3 Equipment which fails to meet the specified requirements and performance test must be corrected and retested until operation is satisfactory without additional cost to the Owner.
- .4 **The Consultant** must be advised prior to all tests and must be given the opportunity to witness any or all tests.
- .5 Provide infrared thermographic inspection of the major pieces of electrical equipment, including switchboards, unit substations, splitter boxes, distribution transformers, and all motor control centers and panels after entire system is in operation.
- .6 Type report of test results must be prepared and submitted for review in accordance with requirements of Division 01.
- .7 Ensure that test reports are submitted as soon as tests are completed. These reports should be included in the O & M Manual only once it is reviewed and approved.

2.03 ACCEPTABLE TESTING FIRMS

- .1 The following testing firms are acceptable:
 - .1 Rondar ((905) 561-2808);
 - .2 Haronitis & Assoc. ((905) 474-0800);
 - .3 Brosz & Assoc. ((905) 472-6660);
 - .4 Schneider ((613) 247-7171);
 - .5 Siemens ((613) 737-607).

3 EXECUTION

3.01 EXECUTION

- .1 Perform tests as required by CSA Z32-15 Standard, as specified, and submit to Consultant a typed written report and a typed table of test results, including a column to indicate a pass or fail result. Person in charge of testing onsite must be experienced in this type of testing. It is expected that this person would not be the same person performing other tests.
- .2 Perform conductor insulation integrity tests on all wiring installed in the course of the work of this Division.
- .3 Ensure that all test reports are submitted as soon as tests are completed. These reports should be included in the O & M manual only once it is reviewed and approved.
- .4 Copies of test reports must be used to prepare typed test reports and be submitted within 10 working days completion of testing for review.
- .5 Test reports are to be included in O & M in manuals after review.

END OF SECTION 26 05 02

1 GENERAL

1.01 REFERENCES

- .1 CSA International.
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC).
- .3 National Electrical Manufacturers Association (NEMA).

1.02 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for wire and box connectors, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance (O&M) data for wire and box connectors for incorporation into manual.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 MATERIALS

- .1 Provide pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required. To CAN/CSA-C22.2 No.65.
- .2 Provide fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors No. 10 AWG or less. To CAN/CSA-C22.2 No.65.
- .3 Provide bushing stud connectors in accordance with EEMAC 1Y-2-1961 to consist of:
 - .1 A connector body and a stud clamp for stranded copper conductors.

- .2 A clamp for stranded copper conductors.
 - .3 Stud clamp bolts, as required.
 - .4 Bolts for the copper conductors.
 - .5 Sized for the conductors, as indicated.
- .4 Provide clamps or connectors for the armoured cable, flexible conduit, as required. To CAN/CSA-C22.2 No.18.

3 EXECUTION

3.01 INSTALLATION

- .1 Remove insulation carefully from the ends of the conductors and:
 - .1 Apply a coat of zinc joint compound on the aluminum conductors prior to the installation of the connectors.
 - .2 Install mechanical pressure type connectors and tighten the screws with an appropriate compression tool recommended by the manufacturer. The installation must meet the secureness tests in accordance with CSA C22.2 No. 65-13.
 - .3 Install the bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION 26 05 20

1 GENERAL

1.01 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 01 and Electrical Specifications.

1.02 STANDARDS

- .1 Provide TECK 90 type cables in accordance with CSA C22.2 No. 131-14 Standard.
- .2 All cables installed in return air plenum space must be FT-6 rated.
- .3 Aluminum cable will not be accepted.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance for wire and cables for incorporation into manual.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 BUILDING WIRES

- .1 Conductors:
 - .1 Copper conductors, of size as indicated, having a minimum conductivity of 98%.
 - .2 Stranded conductors for wires sizes No. 8 AWG and larger.
 - .3 Conductors must be minimum No. 12 AWG, size conductor for maximum 2% voltage drop to the furthest outlet on a fully loaded branch circuit.
 - .4 Conductors must be minimum No.10 AWG for home runs to panels which exceed 20 m.
- .2 Insulation: RW90 is specified. RW90 cable must have thermosetting polyethylene insulation rated at a minimum of 600 V. RWU90 cable to be provided for underground, under slab, and outdoor application. Any underground area where the cable is exposed to moisture.
- .3 Manufacturers: Acceptable manufacturers are:
 - .1 Canada Wire and Cable Limited.
 - .2 Pirelli.
 - .3 Phillips Cables Limited.

2.02 TECK 90 TYPE CABLE

- .1 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 600 V, Type RW 90.
- .2 Inner Jacket: Polyvinyl chloride inner jacket.
- .3 Armour: Interlocking aluminum armour.
- .4 Overall Jacket: Thermoplastic polyvinyl chloride LFS/LGE overall jacket for fire protection and low acid gas evolution, meeting the requirements of the Vertical Tray Fire Test to CSA C22.2 No. 0.3 Standard with a maximum flow travel of 48 in. (1,200 mm) (complying with FT6).
- .5 Fastenings:
 - .1 One-hole malleable iron straps to secure surface mounted cables.
 - .2 12-gauge galvanized-steel channel type supports for two (2) or more cables at 60 in. (1,500 mm) centers.
 - .3 ¼ in. (6 mm) diameter threaded rods to support the suspended channels.
- .6 Connectors:
 - .1 Watertight TECK connectors, ABB, 10464 and 10470 Series.
- .7 Manufacturers: Acceptable manufacturers are:
 - .1 Canada Wire and Cable Limited.
 - .2 Pirelli.
 - .3 Phillips Cables Limited.

2.03 ARMoured CABLES

- .1 AC90 Cable:
 - .1 Conductors: Copper conductors, of size as indicated, having a minimum conductivity of 98%.
 - .2 Insulation: Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 600 V.
 - .3 Armour: Interlocking armour fabricated from aluminum strip. Run length revised per EVE discussion. Refer to the agreed sketch layout.
 - .4 Maximum length of AC90 must be run 10 ft-0 in.
 - .5 Contractor to coordinate ground and neutral requirements to suit specified requirements.
 - .6 AC90 must meet specialty grounding requirements. If grounding requirements are not met, the Contractor must reconsider wiring requirements and note on Supplementary Form.

2.04 CONTROL CABLES

- .1 300 V/600 V Control Cable: Stranded annealed copper conductors sized as indicated, with TWH thermoplastic insulation with a shielding of 100% coverage of aluminum polyester tape and drain wire over each group, and over all conductors and an overall jacket of PVC.
- .2 300 V/600 V cables must comply with the latest CSA CAN 3-C21.2 M86 Standards and Supplements.
- .3 Custom control cables must be designed and assembled in the configurations, as indicated.

- .4 Each conductor must be black and number coded, pairs must be black and white and number coded.
- .5 Acceptable manufacturers are:
 - .1 Belden.
 - .2 Pirelli.
 - .3 Carol.

3 EXECUTION

3.01 GENERAL

- .1 Install grounding, grounded, and neutral conductors without any fuses, switches, or breakers of any kind, unless otherwise indicated.
- .2 Ground the grounded or neutral conductor at the source of supply, as indicated, and isolate grounded or neutral conductor at all other locations.
- .3 Do not use any grounded or neutral conductors as a grounding conductor.
- .4 Do not use any grounding conductor as a grounded or neutral conductor.
- .5 Do not splice any wiring in any raceway. Make splices only at junction boxes.
- .6 Provide enough slack at the connection points of conductors to allow proper connections to be made.
- .7 Do not install any conductors in any raceway until the raceway is complete and cleared of all obstructions. Contractor must blow all lines.
- .8 Install all conductors in any one (1) conduit. At the same time, taking care not to twist the conductors.
- .9 Use wire pulling lubricants that will not shorten the life of the insulation.
- .10 Do not install any wires or cables at temperatures above or below those which will cause damage to wires or cables.

3.02 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In surface and lighting fixture raceways in accordance with Section 26 05 30.

3.03 INSTALLATION OF TECK 90 - 1000 V

- .1 Install cables as indicated.
- .2 Group cables wherever possible on channels.
- .3 Terminate cables in accordance with Section 26 05 20.

3.04 INSTALLATION OF ARMORED CABLE

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20.
- .3 Coordinate neutral and grounding requirements.

3.05 INSTALLATION OF MINERAL INSULATED CABLE

- .1 Install cable exposed, as indicated, securely supported by straps.
- .2 Make cable terminations by using factory-made kits.
- .3 At cable terminations, use thermoplastic sleeving over bare conductors.
- .4 Where cables are embedded in cast concrete or masonry, provide a sleeve for the entry or exit of cables.
- .5 Do not splice cables.
- .6 Provide cable to maintain protection of life safety circuits.

3.06 INSTALLATION OF SECURITY AND FIRE ALARM CABLES

- .1 Install cables in accordance with Section 28 00 00.

END OF SECTION 26 05 21

1 GENERAL

1.01 REFERENCES

- .1 CSA International.
 - .1 CSA Standard C22.2 No. 41-13 - Grounding and Bonding Equipment.
 - .2 CSA Z32-09, Electrical Safety and Essential Electrical Systems in Health Care Facilities.
- .2 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE).
 - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.02 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for grounding wire and connectors, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance (O&M) data for grounding wire and connectors for incorporation into manual.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 MATERIAL

- .1 Provide grounding clamps for grounding conductors, of size as required, on all electrically conductive underground water pipes, ABB 3902 Series.
- .2 Provide systems circuit grounding conductors and equipment grounding conductors of bare stranded copper, soft annealed, of size as indicated.

- .3 Provide a green RW90 insulated grounding conductors of sizes as indicated. UPS grounding conductor must be green with a yellow line the full length of the conductor. The conductor must be RW90/RWU90, size as noted.
- .4 Provide copper ground bus bars 0.24 in. x 2 in. (6 mm x 50 mm), complete with insulated supports, fastenings, and connectors. Length and routing of ground bus must be as indicated on drawings.
- .5 Provide all non-corroding accessories necessary for the grounding system of the type, size, and material as indicated, including, but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers and straps.
 - .6 Compression wire connectors.

3 EXECUTION

3.01 INSTALLATION - GENERAL

- .1 Install a complete, permanent and continuous systems circuit grounding system, and an equipment grounding system, including electrodes, conductors, connectors, and accessories, as indicated, to comply with the requirements of these Specifications and the local Authority Having Jurisdiction over the installation.
- .2 Install connectors in accordance with the manufacturer's instructions.
- .3 Protect all exposed grounding conductors from mechanical injury.
- .4 Make buried connections and connections to conductive water mains and electrodes using a thermit copper welding process or compression type connectors.
- .5 Use compression connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints are not permitted.
- .7 Install an insulated bonding conductor inside each flexible conduit, flexible liquid-tight conduit, and conduit run with an expansion joint with the conductor connected at both ends to grounding. Provide RWU90 and RW90 types to suit conduit.
- .8 Install flexible ground straps, where such bonding is not inherently provided with equipment, for the following:
 - .1 Cabletrough joints; cable tray and raceways;
 - .2 Cabletrough expansion joints.
- .9 Install a separate grounding conductor in the following:
 - .1 All EMT/ENT conduit runs;
 - .2 All PVC conduit runs;
 - .3 All underground or under slab runs;
 - .4 All direct buried runs. Provide *tracer* wire prior to backfilling #10 std, white.
- .10 Connect building structural steel and metal siding to ground.
- .11 Make grounding connections in a radial configuration only with the connections terminating at a single grounding point at the street side of the water meter. Do not make loop connections, except as indicated.
- .12 Bond single conductor, metallic armored cables to the cabinet at the supply end and provide a non-magnetic entry plate at the load end and at the load end.

- .13 Provide a grounding system with a maximum resistance to ground of 5 ohms.

3.02 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to the neutral of the primary 600 V system, secondary 120/208 V system.

3.03 COMMUNICATION SYSTEMS

- .1 Install grounding connections for life safety and all other systems, minimum #6 insulated ground wires.

3.04 GROUNDING OF AUDIO/VISUAL SYSTEM (IF APPLICABLE)

- .1 Provide one (1) #6 insulated ground wire from main electrical room ground bus to each Audio/Visual closet(s).

3.05 GROUNDING OF SECURITY SYSTEM AND FIRE ALARM SYSTEM (IF APPLICABLE)

- .1 Refer to Section 28 00 00 and documents.

END OF SECTION 26 05 28

1 GENERAL

1.01 GENERAL

- .1 Not Applicable.

2 PRODUCTS

2.01 SUPPORT CHANNELS

- .1 U-shaped, steel channel, accurately cold rolled formed from 12-gauge, low carbon steel with finished dimensions of 1-⁵/₈ in. x 1-⁵/₈ in. (3.1 mm x 3.1 mm), interned clamping ridges, and a continuous slot along one (1) side for the insertion of slotted nuts. Hot dip galvanized the channel after fabrication with a zinc weight of 1.5 oz/ft sq.
- .2 Nuts with tow (2) serrated grooves to engage the clamping ridges of the channel, a spring to hold the nut in place during installation and threaded with Unified and American course threads. Case harden and electrogalvanized after fabrication.
- .3 Electrogalvanized bolts, threaded rod, flat, and lock washers, as required.
- .4 Angle, "U", "Z", and special fittings, brackets, bases, clamps, hangers, couplings, and other fittings, as required, and galvanized, unless otherwise indicated.
- .5 Provide channel and fittings of one (1) manufacturer. Acceptable manufacturers are:
 - .1 Unistrut of Canada Ltd.
 - .2 Burndy Canada Ltd.
 - .3 Electrovert Ltd.
- .6 All support channel supports are to be safe and installed to prevent injury. Including support screws.

2.02 CONCRETE ANCHORS

- .1 Drilled expansion anchors for anchors set in concrete block or poured concrete after the concrete has set. Size insert and number of anchors so that the maximum load per anchor does not exceed 25% of the manufacturer's published maximum loading.
- .2 Provide concrete anchors of one (1) manufacturer. Acceptable manufacturers are:
 - .1 Hilti Canada Ltd.
- .3 "U"-channel concrete inserts must be 12-gauge steel 1-⁵/₈ in. square with insert anchors 1-³/₈ in. long and 4 in. on center. Acceptable manufacturers are:
 - .1 Unistrut.
 - .2 Electrovert Limited.
 - .3 Burndy Canada Ltd.

3 EXECUTION

3.01 INSTALLATION

- .1 Secure equipment to masonry, tile, and plaster surfaces with lead anchor, drive pin anchors are not permitted.
- .2 Secure equipment and concrete inserts to poured concrete with expansion anchors.

- .3 Secure equipment to suspended ceilings with toggle bolts.
- .4 Support equipment, conduit, or cables using clips, spring loaded bolts, cable clamps designed as accessories to the basic channel members.
- .5 Fasten exposed conduit or cables to the building construction or support system using straps:
 - .1 1-hole steel straps to secure surface conduits and cables 2 in. (50 mm) and smaller.
 - .2 2-hole steel straps for conduits and cables larger than 2 in. (50 mm).
 - .3 Beam clamps to secure the conduit to the exposed steel work.
- .6 Suspended Support Systems:
 - .1 Support individual cable or conduit runs with 0.24 in. (6 mm) diameter threaded rods and spring clips.
 - .2 Support two (2) or more cables or conduits on channels supported by 0.24 in. (6 mm) diameter threaded rod hangers where direct fastening to the building construction is impractical.
- .7 Use channels at a maximum 3 m center to center for surface mounting of two (2) or more conduits.
- .8 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support the conduit and cable runs.
- .9 Provide adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with the permission of Consultant.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with the manufacturer's installation recommendations.

END OF SECTION 26 05 29

1 GENERAL

1.01 REFERENCE

- .1 Electrical General Provisions.

1.02 RELATED WORK

- .1 Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.
- .2 Section 26 05 21 - Wires and Cables up to 1000 V.
- .3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Section 26 05 20 - Wire and Box Connectors up to 1000 V.
- .5 Section 28 31 00 - Fire Alarm System.

2 PRODUCTS

2.01 PRODUCTS

- .1 Not Applicable.

3 EXECUTION

3.01 GENERAL

- .1 General: All wiring must be recessed when located in finished areas. Surface-mounted wiring may be used in mechanical rooms, service spaces, or as indicated. In cases where exposed conduit is approved, the installation should be along building lines and tighten to the structural underside. Provide protection to conduits which may be subject to mechanical damage.
- .2 All wires, including neutrals and grounds, must be labeled at both ends (tagged).
- .3 Branch Medium Voltage Feeders: Wire in conduits.
- .4 Main 600/347 V and 120/208 V, 3 Phase Wire Distribution:
 - .1 Type RW90 in conduits; busways, etc.
 - .2 Main mechanical systems feed - wire in conduit; busways, etc.
 - .3 All other feeders as detailed on drawings; wire in conduit.
 - .4 Provide applicable insulation for the environment the feeder(s) must be installed. i.e. use RWU90 for underground, in-ground, under slab on grade, exterior, etc., any location where cables are exposed to moisture.
- .5 General Power and Lighting Distribution: Wire in conduit.
 - .1 Branch circuit wiring within drywall partitions; wire in conduit.
 - .2 Final drops to luminaires with limited length (10 ft-0 in. max) may be made with Type AC90 cable or wire in conduit.
 - .3 All other power and distribution must be wire in conduit.
- .6 Fixture Wiring: Flexible wiring systems for all recessed ceiling mounted fixtures (all other are wire in conduit).
- .7 Fire Alarm System:

- .1 Wire in conduits to maintain and ensure required fire rating.
- .2 Flexible watertight connections to supervised valves, pressure switches, flow switches, smoke dampers, etc.
- .8 Telephone and Data Communication Systems:
 - .1 Two (2) pull strings in conduit, attached at both ends of the conduit.
 - .2 Size of conduits for drops, as indicated.
 - .3 Minimal conduit size of 27 mm.
- .9 Motor and Control Wiring:
 - .1 Wire in conduit.
 - .2 Flexible seal-tite connection must be made between all non-flexible conduit assemblies and vibrating parts (e.g. between motors and conduits), with a 180° loop and watertight connections.
- .10 Security Systems:
 - .1 Two (2) pull strings and wire in conduit.
 - .2 Size of conduits, as indicated.
- .11 Occupancy Sensors: Wire in conduit.

END OF SECTION 26 05 30

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, 22nd Edition.

1.02 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for outlet boxes, conduit boxes, and fittings, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.03 CLOSEOUT SUBMITTALS

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

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 OUTLET AND CONDUIT BOXES - GENERAL

- .1 Provide 4 in. (102 mm) square or larger outlet boxes, as required for special devices.
- .2 Provide gang boxes where wiring devices are grouped.
- .3 Provide deep masonry boxes (MBS Series) for data communications outlets in dry wall partitions, complete with the required support brackets and clips.
- .4 Provide combination boxes with barriers where outlets for more than one (1) system are grouped. Combination boxes must be multi-ganged shallow masonry box (MBS Series), complete with barrier and the required support brackets and clips.
- .5 Outlet boxes, conduit boxes, and fittings to be to CSA C22.2 No. 18.2-06.

2.02 SHEET STEEL OUTLET BOXES

- .1 Provide single and multigang electro-galvanized steel flush device boxes as required for flush installation, minimum size 3 in. x 2in. x 1-½ in. (76 mm x 50 mm x 38 mm) or as

required. Provide 4 in. (100 mm) GSB Series outlet boxes when more than one (1) conduit enters one (1) side. Add extension and plaster rings as required.

- .2 Provide 4 in. (100 mm) square or octagonal outlet boxes for luminaire outlets.
- .3 Provide 4 in. (100 mm) square outlet boxes with extension and plaster rings for flush-mounted devices to suit wall finish, as required.

2.03 MASONRY BOXES

- .1 Provide single and multigang electro-galvanized steel masonry boxes as required for devices flush mounted in concrete block walls.
- .2 Electrical Contractor must confirm prior to installation with Prime Consultant where box and cover plate meet with motor joints.

2.04 CONCRETE BOXES

- .1 Provide deep cast-iron concrete type boxes for flush mount in concrete with matching extension and plaster rings as required. Boxes to be installed in concrete must be approved for this purpose. Refer to Wiring Device section.

2.05 CONDUIT BOXES

- .1 Provide cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for the surface wiring of switches and receptacles, as required.
- .2 Electro-galvanized utility type for indoor surface wiring.

2.06 FITTINGS - GENERAL

- .1 Provide bushing and connectors with nylon insulated throats.
- .2 Provide knock-out fillers to close unused knock-outs.
- .3 Provide conduit outlet bodies for conduit up to 1-¼ in. (32 mm) and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Factory made vapor barriers designed for sheet steel outlet boxes.

3 EXECUTION

3.01 INSTALLATION

- .1 Support all boxes independently of the connecting conduits. All boxes to be hung independently of ducts, pipes, etc.
- .2 Fill boxes with sponges, foam, or similar approved material to prevent the entry of foreign material during construction.
- .3 For flush-wall installations, mount the outlet boxes flush with the finished walls using plaster rings to permit the wall finish to come within 0.24 in. (6 mm) of opening. Coordinate with Architectural Drawings for wall construction and provide extender ring(s) to suit.
- .4 Provide the correct size of openings in the boxes for the conduit and armored cable connections. Reducing washers are not permitted.

- .5 Location of boxes not to interfere with removal of ceiling tiles.
- .6 For boxes mounted with in split-face block walls, the Electrical Contractor must carry the cost of the Mason Contractor to grind the block so as the box and cover plate sit flush. Both Contractors must provide a mock-up for the Prime Consultant for review.

END OF SECTION 26 05 32

1 GENERAL

1.01 REFERENCE

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04(R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 C22.2 NO. 83.1-07 (R2012), Electrical Metallic Tubing.
 - .5 C22.2 NO. 211.2-06 (R2011), Rigid PVC (Unplasticized) Conduit.

1.02 LOCATION OF CONDUIT

- .1 The drawings do not show all conduits. Those shown are in diagrammatic form only but show the general intent. The Electrical Contractor must provide detailed routing drawings for coordination.
- .2 Conduits are to be provided to create complete raceway systems.
- .3 Refer to Structural Drawings for the extent of hollow-core slabs (if applicable). Openings through hollow core slabs must be limited and must be approved by Structural Engineer.
- .4 Prior to any installation of recessed conduits in the slab or passage of conduits through the slab, the Contractor must submit the proposed routes to the building's Structural Engineer for approval prior to installation along. The Electrical Contractor must scan the slab and share scan results along with the request to the building's Structural Engineer. All conduit sizes to be labeled. Failure to submit conduit routing layouts prior to installation may result in the removal of conduits at the cost of both the General and Electrical Contractors.

1.03 NUMBER AND SIZES OF CONDUITS

- .1 Conduits to be provided must be as indicated in documents and/or as required to suit requirements of systems installed, as specifically noted within this Specification.

1.04 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for conduits, fastenings, and fittings, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.05 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance (O&M) data for wire and box connectors for incorporation into manual.

1.06 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 CONDUITS

- .1 Contractor must not use conduits smaller than $\frac{3}{4}$ in. (19 mm), unless specifically indicated.
- .2 Electrical metallic tubing (EMT) with couplings.

2.02 CONDUIT FASTENINGS

- .1 One-hole malleable iron, hot dipped galvanized straps to secure surface-mounted conduits. Thomas & Betts 1275 Series for rigid, threaded conduit and ABB 4175 Series for EMT complete with properly sized flat head screw.
- .2 Beam clamps to secure conduits to exposed steel members.
- .3 Provide $1\text{-}\frac{5}{8}$ in. x $1\text{-}\frac{5}{8}$ in. galvanized-steel channel type supports for two (2) or more conduits on a minimum 2,000 mm centers. Use suitable conduit clamps in channel.
- .4 Provide .24 in. (6 mm) dia. threaded rods to support the suspended channels.

2.03 CONDUIT FITTINGS

- .1 Fittings manufactured for use with the conduit specified with the same coating as conduit.
- .2 Provide insulated bushings on all rigid, threaded conduits.
- .3 Factory "ells" where 90-degree bends are required for 25 mm and larger conduits.
- .4 Provide steel couplings and connectors for all EMT conduits, screw type. Liquid-tight (zinc alloy) compression connectors and couplings.

2.04 FISH CORD

- .1 Polypropylene.

3 EXECUTION

3.01 INSTALLATION

- .1 Install all conduits to conserve headroom in exposed locations and to cause minimum interference in the spaces through which they pass.

- .2 Conceal all conduits, except in unfinished areas, unless otherwise indicated.
- .3 Do not surface mount conduits on building exterior surfaces, unless otherwise indicated or approved by Prime Consultant.
- .4 All equipment boxes and conduit on columns to be recessed.
- .5 Bend conduit cold. Replace conduit if kinked or flattened more than $\frac{1}{10}$ th of its original diameter.
- .6 Mechanically bend steel conduit over $\frac{3}{4}$ in. (19 mm) dia.
- .7 Field threads on rigid conduit must be of enough length to draw conduits up tight.
- .8 Install fish cord in all conduits.
- .9 Run four (4) 1 in. (25 mm) spare conduits up to ceiling space and four (4) 1 in. (25 mm) spare conduits down to accessible ceiling space from each recess mounted panel. Terminate these conduits in 12 in. x 12 in. (305 mm x 305 mm) junction box, respectively. Identify the junction box and label. Pack and seal penetrations to maintain fire ratings.
- .10 Where conduits become blocked, remove and replace blocked section.
- .11 Dry conduits out before installing wire.
- .12 Do not fasten conduits to metal roof decks.
- .13 Use rigid, threaded Schedule 40, galvanized steel threaded conduit, except where specified otherwise.
- .14 Use electrical metallic tubing (EMT) in all areas, unless specifically indicated and not subject to mechanical injury. EMT must not be used under slab or in slab.
- .15 Use liquid-tight flexible conduit for connections to motors, connections for all exterior light fixtures, connections for all exterior systems, connection to recessed incandescent fixtures without a pre-wired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .16 Use liquid-tight flexible metal conduit for connection to motors, transformers, etc.

3.02 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 4.9 ft (1.5 m) clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels provided accepted by Structural Consultant.
- .5 Do not pass conduits through structural members, except as permitted by Structural Consultant.
- .6 Do not locate conduits less than 3 in. (75 mm) parallel to steam or hot water lines with a minimum of 1 in. (25 mm) at crossovers.

3.03 CONCEALED CONDUITS

- .1 Do not install horizontal runs in masonry or partition walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

- .3 Do not pass conduits through shear walls.

3.04 LOCATION OF CONDUITS

- .1 Care must have been taken to indicate the routes and the placements in which conduits can be located as most conduits are exposed/surface mounted and must be reviewed by the Architect.
- .2 Locations, radius, and numbers with dimensions indicate all conduits related to gridlines.
- .3 Installation of conduits of slab on grade, and/or in slabs must confirm to structural requirements. Routes must be submitted to Structural Consultant for review.
- .4 Where conduits and boxes embedded in concrete slabs and walls, and the slabs and walls must be finished with insulation, acoustical panels, etc. Extension boxes must be installed to bring the devices to the same finished surface. Electrical Contractor must review Architectural Drawings prior to Price Submission.

END OF SECTION 26 05 34

1 GENERAL

1.01 GENERAL

- .1 Comply with the requirements of Section 26 05 01.
- .2 Provide mock-up of identification labels for approval.

2 PRODUCTS

2.01 NAMEPLATES

- .1 Construct all nameplates from laminated plastic having a black core with a white top lamination such that engraving through the top lamination will reveal black lettering on a white background.
- .2 Construct all warning nameplates from laminated plastic having a red core with a white top lamination such that engraving through the top lamination will reveal red lettering on a white background.
- .3 Submit two (2) samples to the Owner's Project Administration Team for review prior to manufacturing.

2.02 SIZES

- .1 Provide nameplates of sizes indicated. Where a size is not given, provide a standard size nameplate of sufficient size to contain the text indicated.
- .2 Where a numerical size is indicated, provide a nameplate of a size as indicated in the table below. Provide lettering of the height indicated below, unless another size is indicated.

Size	Width in. (mm)	Height in. (mm)	First Line Lettering Height in. (mm)	Following Lines Lettering Height in. (mm)
1	2 (50)	1 (25)	.5 (13)	--
2	3 (75)	2 (50)	.5 (13)	.4 (10)
3	4 (100)	2 (50)	1 (25)	.4 (10)
4	8 (200)	4 (100)	1 (25)	.4 (10)

- .3 Provide lettering of the height indicated. Where no height is indicated, provide lettering 4 in. (100 mm) high.

2.03 SPECIFIC NAMEPLATES

- .1 Submit mock-ups for review prior to manufacturing.
- .2 For each distribution transformer, provide a nameplate to indicate the following information. The number in brackets indicates the lettering height:
 - .1 Line 1: Equipment tag number: 1 in. (25 mm).
 - .2 Line 2: Rated voltage, kVA, phase and frequency: 4 in. (100 mm).
 - .3 Line 3: Power source: 4 in. (100 mm).

- .4 Example: TX-6A54 600V 208/120V, 112.5 kVA, 3-phase, 4-wire 60 Hz fed from DP-6A54.
- .3 For each panelboard, provide a nameplate to indicate the following information. The number in brackets indicates the lettering height:
 - .1 Line 1: Equipment tag number: 1 in. (25 mm);
 - .2 Line 2: Rated voltage, phase and wires: 4 in. (100 mm);
 - .3 Line 3: Power Source: 4 in. (100 mm);
 - .4 Example: LP-6A52 600/347V, 3-phase, 4-wire fed from DP-6A52.
- .4 For each disconnect switch, contactor and individual starter, provide a nameplate to indicate the following information. The number in brackets indicates the lettering height:
 - .1 Line 1: Equipment tag number: 1 in. (25 mm);
 - .2 Line 2: Rated voltage, current, phase and wires: 4 in. (100 mm);
 - .3 Line 3: Power source: 4 in. (100 mm);
 - .4 Example: DS-2B31 208/120V, 100A, 3-phase, 4-wire fed from SP-2B51.
- .5 For each fan control switch, provide a nameplate to indicate the following information. The number in brackets indicates the lettering height:
 - .1 Line 1: in.FAN SWITCH in. + Equipment tag number .4 in. (100 mm);
 - .2 Example: FAN SWITCH EF-15.

3 EXECUTION

3.01 INSTALLATION

- .1 Install nameplates on the front of the equipment on a prominent flat surface. Attach the nameplates with screws or rivets.

END OF SECTION 26 05 53

1 GENERAL

1.01 SCOPE OF WORK

- .1 The power system protection must be implemented through the short circuit study and system coordination by professional specializing in the field. All information required to do this must be obtained through formal requests to related trade such as mechanical, local Utility, manufacturers supplying the equipment.
- .2 Safety aspects of NFPA 70-E must be implemented thru proper study as indicated in the Specifications. See details in item 1.06.
- .3 Any exception desired to this Specification must be obtained in writing at least two (2) weeks in advance of bidding. Consultant and Owner must make final decision and communicate to all concerned.

1.02 REFERENCES

- .1 Electrical Specifications, but not limited to.
- .2 Electrical General Provisions.
- .3 Operating and Maintenance (O&M) Manuals.
- .4 Service Entrance and Utility Requirements.
- .5 Liquid-Filled Distribution Transformers.
- .6 Primary Medium Voltages Switchgear Assemblies and Secondary Switchboards.
- .7 Dry Type Transformers up to 600 V Primary.
- .8 Breaker Type Panelboards.
- .9 Air Circuit Breakers.
- .10 Moulded Case Circuit Breakers.
- .11 Low Voltage Fuses.
- .12 Motor Control Centres.
- .13 Elevators.
- .14 Generators.
- .15 Fire Pump.

1.03 DESCRIPTION OF WORK

- .1 This Contractor must provide system coordination for the entire system.

1.04 SYSTEM CO-ORDINATION

- .1 Retain one (1) of the designated testing companies who specialize in this type of work to prepare an equipment coordination study and schedule for all protective devices in the system in cooperation with suppliers of all pertinent switchgears, and include the cost of his services in the tender price.

- .2 The firm of testing specialists must be responsible for checking, adjusting, calibration, and setting up of all protective devices in accordance with the values shown in the approved Coordination Study under this Contract.
- .3 Coordinate relays, breakers, and fuses to provide selective tripping or blowing. Coordinate breakers, fuses, protective relaying, and ground fault protection so that the breaker or fuse immediately ahead of a fault will trip or blow clearing the fault and leaving the system ahead of the tripped or blown protective device in the normal operating conditions. The Coordination Schedule must be drawn up and submitted to the Construction Manager/General Contractor for review.
- .4 The curves must be accompanied by the individual time current curves of each device to enable the verification of the ratings and settings used. These coordination curves must be submitted for review and the various ratings and settings must be made by the manufacturer before the equipment is shipped. Review of these coordination curves will not eliminate the responsibility of this contractor to provide correct coordination.
 - .1 Co-ordination curves must be plotted showing the following:
 - .1 Supply Authority's relays or fuses protecting the incoming service. This information must be obtained directly from Utility;
 - .2 Main and feeder protection devices at every voltage level;
 - .3 Protection devices associated with the largest motor or refrigeration compressor;
 - .4 Protection devices associated with the emergency power distribution system and showing general fault levels;
 - .5 Ground fault co-ordination;
 - .6 Fire pump inrush.
 - .2 Each co-ordination time-current curve must include:
 - .1 A single-line diagram for the portion of the system involved.
 - .2 Transformer and cable damage curves where applicable.
 - .3 Available fault current level on the portion of the system involved.
 - .4 Generator fault and damage curves where applicable.
- .5 Coordination curves must be submitted as part of a report outlining the Coordination Procedures, final breaker, and relay settings and fuse ratings for the entire power distribution system. The report must clearly list all breakers with their tag and final settings even if there are identical systems on the project, i.e. information about the same settings can be duplicated, if applicable, with breaker in different locations. This list will be checked and signed out by the engineer who prepared the study and later submitted to Consultant at the end of the commissioning.
- .6 Co-ordinate with the refrigeration equipment manufacturer and obtain the recommended settings on protection devices (Ref.: Breaker and overloads). Incorporate this information on the associated co-ordination curves.


1.05 STANDARDS

- .1 ANSI/IEEE Standard 242-2001, Recommended Practice for Protection and Coordination of Industrial and Commercial Power System.
- .2 ANSI/IEEE Standard 399-1997, Recommended Practice for Industrial and Commercial Power System Analysis.
- .3 IEEE STD- 1584-2002, Guide for Performing Arc Flash Hazard Calculations.
- .4 NETA STD.ATS 2013, Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

- .5 NFPA 70E, Standard for Electrical Safety in the Workplace.

1.06 ARC FLASH HAZARDS

- .1 The designated professional, who has been working on this for at least three (3) years, must be preparing a complete report based on final single-line diagram and cable lengths, size, and type provided by Contractor. The report must provide full summary of the Arc Flash Hazard. This will include compliance with NFPA 70E and related methods established in the industry. IEEE-1584 will provide guide to calculation of the incident energy. The study will ensure that worst case hazards are identified. This would mean that arc energy is calculated at maximum fault and at overloads, where applicable.
- .2 The study must cover all distributed equipment and voltage levels within the facility as well as the main incoming service to the building. The study will identify the arc flash boundaries and incident energy at suggested distance of working. Determination of system operating modes and conditions that can impact short-circuit currents and arc flash hazard energy levels must be identified well in advance and must be conveyed to Owner and Consultant for confirmation.
- .3 The study will clearly report assumptions made for arc-fault currents. L-G ground fault and L-L-L-G fault worst-case scenarios must be reported as minimum requirement. Arc-Flash labels must be provided for each protective equipment.
- .4 The labels must be per ANSI Z535. The labels must identify the hazard level and protective clothing required.
- .5 The label reflected below is an example required detail of what is to be on the label is reflected below. A separate label must be provided for each piece of both the normal and emergency power distribution systems.

		WARNING		LABEL #
		ARC FLASH HAZARD		
LINE SIDE	FLASH PROTECTION BOUNDARY:	40 inches		
of MAIN	HAZARD RISK CATEGORY:	2		
INCIDENT ENERGY RANGE: 4 – 8 cal/cm² at 24" WORKING DISTANCE				
LOAD SIDE	FLASH PROTECTION BOUNDARY:	20 inches		
of MAIN	HAZARD RISK CATEGORY:	0		
INCIDENT ENERGY RANGE: 0 – 2 cal/cm² at 24" WORKING DISTANCE				
PSE TQS#: #####		Date Issued: April 2004		Study Rev.: 0
LOCATION: BUS NAME		PROTECTIVE DEVICE: UPSTREAM DEVICE		

- .6 The Arc Flash Warning Label must have, as a minimum, the following information reflected on it:
 - .1 Boundaries as per NFPA:
 - .1 Flash protection boundary;
 - .2 Limited shock approach boundary;
 - .3 Restricted shock approach boundary;
 - .4 Prohibited shock approach boundary.
 - .2 Personal Protective Equipment (PPE) required to be used with respect to said piece of equipment;
 - .3 Available Short Circuit Current;
 - .4 Incident Energy at 18 in.;
 - .5 Voltage Shock Hazard.
- .7 At least 24-hour training must be provided to the staff employed at the facility to explain meaning of labels and protective equipment, and work permits for energized work. This is to ensure the implementation of the safety program.

2 PRODUCTS

2.01 PRODUCTS

- .1 Not Applicable.

3 EXECUTION

3.01 INSTALLATION

- .1 On completion of calibration and testing, a full report must be prepared by the testing specialists and submitted to the Construction Manager/General Contractor for review, comments, and approval.
- .2 The report must confirm that all protective devices have been adjusted and set in accordance with the coordination study and that the protective systems provide the necessary degree of selective protection.
- .3 The report must include tabulation of settings and/or rating of all protective devices.
- .4 Each protective device must be labelled with the proper setting for the device. Labels must be installed or marked on the protective device behind glass windows. Fusible devices must be labelled showing the size, type, and current rating of the fuse element.
- .5 The firm conducting the coordination study must conduct onsite verification testing to ensure that all relays, breaker settings, and fuse sizing have been set in accordance with the coordination study recommendations.
- .6 The Owner reserves the right to retain the services of an independent testing company to monitor, review, and verify results of the test report submitted by the Contractor.
- .7 Provide the services of electricians to assist in equipment tests performed by the independent testing companies appointed by the Owner, including thermographic (infrared) testing of bus bar joints and contacts of circuit breakers, etc. Remove cover plates, etc., to enable testing company to gain access to the equipment.
- .8 The Contractor must be responsible to co-ordinate with equipment manufacturers to ensure that the equipment is provided with protection as recommended in the co-ordination study.

- .9 Co-ordination studies and testing must be performed by Brosz and Associates, Haronitis Associates, K-Tech, GT Wood, Eaton Electrical, or Schneider Canada.
- .10 Upon completion of the Project, during the commissioning stage, conduct a complete infrared scan of the distribution system for main switchboards, distribution panel power panels, and MCCs for both normal and generator powers.
- .11 After 6 to 12 months of facility operation during summer (i.e in July and August), a 48-hour harmonic analysis must be conducted during working weekdays on all MCC/DP supplying VFD systems and DP/Panelboards supplying computer loads, to address the power quality and power factor and identify major sources of harmonic interference. Submit a professional report of the findings to the Owner.
- .12 One year following the completion of the analysis repeat the complete infrared scan and submit a report of the findings to the Owner.
- .13 The coordination study must be done in advance of equipment being manufactured and delivered to site. The Contractor must act upon the recommendation of the coordination study and include for any modifications deemed necessary by the study to the electrical distribution system at no extra cost.
- .14 Affix all Arc Flash Hazard warning labels on the appropriate equipment.

4 SUBMITTAL INFORMATION

4.01 ADDITIONAL INFORMATION WITH COORDINATION STUDY

- .1 The following documents would be formally obtained during the Project for system coordination. It is required that a detailed list must be submitted along with coordination study as a reference.

#	Title	Date on document	Total Pg.	Rev#	Remarks detailed or V=Verified, R=Requested (but not seen) N= Not Applicable
1	Consultant's Single-Line Diagram of the Project				
2	Consultant's Mechanical Equipment Formal Shop Drawings with Appropriate Electrical Data for Larger and Important Components (Motors starters, VFD) of the Project				
3	Manufacturer's Formal Documents Confirming Transformer Impedance and Inrush Current Dedicated to Project				
4	Circuit Breaker Data from Manufacturer's Formal Documents Dedicated to Project, Including Important Correspondence				
5	Utility/Upstream Devices Related Data as Obtained by System Coordination Professional or Authentic Documented Study				
6	Generator Damage Curve-Technical Data Verifications				

#	Title	Date on document	Total Pg.	Rev#	Remarks detailed or V=Verified, R=Requested (but not seen) N= Not Applicable
7	VFD (>25 HP) Devices Protection Components such as Fuses/Circuit Breakers that are Recommended by Supplier				
8	Cable lengths, Size and Type as Confirmed and Signed by the Division 26 Contractor				
9	Important Correspondence Affecting the Study				
10	Electrical Safety Authority System Coordination Correspondence.				

END OF SECTION 26 05 73

- .1 general

1.02 GENERAL REQUIREMENTS

- .1 This Section covers items common to all sections of Division 16, Instructions to Bidders, any Supplements and / or Addenda thereto form an integral part of this Specification and must be read in conjunction herewith.
- .2 Conform to requirements of Contract Documents.

1.03 WORK INCLUDED

- .1 Provide Surge Protective Devices (SPDs) at the service entrance switchboard.
- .2 Provide SPDs at the receptacle panels as indicated on the drawings.

1.04 STANDARDS

- .1 SPDs shall be listed in accordance with UL 1449 3rd Edition (or most recent edition) and shall be CSA or cUL approved.

2 Products

2.01 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

- .1 Units shall be incorporated into service entrance equipment by switchboard manufacturer.
- .2 SPDs shall be CSA or cUL/UL 1449 labeled with a 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of the SPD.
- .3 Suppressors shall provide suppression elements between each phase conductor and the system neutral and ground. Suppression elements shall incorporate thermally protected metal-oxide varistors (TPMOVs). Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- .4 SPDs shall be CSA or cUL/UL 1449 labeled with a 20kA I-nominal rating regardless of Type designation.
- .5 Visible indication of proper suppressor connection and operation shall be provided. The indicator shall consist of at least one LED per phase. No single LED or neon indicators shall be used.
- .6 Suppressors shall meet or exceed the following criteria:
- .1 Minimum single impulse current rating (L-N + L-G): 200,000 amperes per phase.
 - .2 UL 1449 Voltage Protection Ratings shall not exceed the following:

Voltage	L-N	L-G	N-G
120 / 208	700	700	700
277 / 480	1200	1200	1200
347 / 600	1500	1500	1500

- .7 Suppressors shall consist of solid-state components and shall operate bi-directionally.
- .8 The SPD shall be equipped with an audible alarm which shall actuate when any part of the surge circuitry has been damaged. A silence button must be provided with the alarm.
- .9 The surge suppressor shall incorporate an internal disconnect (3 pole, UL approved).
- .10 The suppressor shall have a warranty guarantee for a period of ten years.

2.02 RECEPTACLE PANELBOARD SURGE PROTECTIVE DEVICE

- .1 SPDs shall be CSA or cUL/UL 1449 labeled with a 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of the SPD.
- .2 Suppressors shall provide suppression elements between each phase conductor and the system neutral and ground. Suppression elements shall incorporate thermally protected metal-oxide varistors (TPMOVs). Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- .3 SPDs shall be CSA or cUL/UL 1449 labeled with a 20kA I-nominal rating regardless of Type designation.
- .4 Visible indication of proper suppressor, connection and operation shall be provided. The suppressor shall have an audible alarm that will activate upon failure of any mode.
- .5 Suppressors shall meet or exceed the following criteria:
 - .1 Minimum single impulse current rating (L-N + L-G): 100,000 amperes per phase.
 - .2 UL Voltage Protection Ratings (VPRs) shall not exceed the following:

	Voltage	L-N	L-G	N-G
Article I.	120 / 208	700	700	700
Article II.	277 / 480	1200	1200	1200
	347 / 600	1500	1500	1500

- .6 Suppressors shall consist of solid-state components and operate bi-directionally. The units shall be either flush or surface mounted type, as required.
- .7 The suppressor shall have a warranty guarantee for a period of ten years.

2.03 MANUFACTURERS

- .1 Advanced Protection Technologies
- .2 Siemens
- .3 Or approved equal

3 Execution

3.01 INSTALLATION AT SERVICE ENTRANCE

- .1 Install one primary suppressor at utility service entrance to the facility, according to the manufacturer's recommendations.
- .2 Suppressor shall be installed on the load side of the service entrance.
- .3 Conductors between suppressor and point of attachment shall be kept as short and straight as possible. Lead length of connecting conductor shall not exceed 10 feet.
- .4 Suppressor's ground shall be bonded to the service entrance ground.

3.02 INSTALLATION AT RECEPTACLE PANELS

- .1 Install one secondary suppressor at each location or as required.
- .2 Suppressor shall be connected to the panel, per the manufacturer's installation instructions. Provide a 30A-3 pole breaker in panel to attached surge panel to electrical distribution system.
- .3 Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible. The maximum length of connecting wiring shall not exceed 12 inches on any phase connection and 24 inches on the neutral and ground leads.

END OF SECTION 26 09 14

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 06 10 11 - Rough Carpentry Backerboard Materials and Construction.
- .2 Section 09 91 23 - Interior Painting: Fire Retardant Intumescent Coating for Backer Boards.
- .3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2 No.29-11, Panelboards and enclosed Panelboards;
 - .2 CAN/CSA Standard C22.2 No. 94 – M91 (R2011) – Special Purpose Enclosures.
- .2 Canadian Electrical Safety Code, latest Edition and Ontario Supplements.

1.03 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for distribution panels, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance (O&M) data for distribution panels for incorporation into manual.

1.05 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 GENERAL

- .1 Distribution panels must be surface or flush-mounted type, as shown.
- .2 Panels must be of steel construction, without overall doors, unless shown otherwise.
- .3 Panels must be given a rust-resistant treatment to both tub and trim.

- .4 Flush panels must be CSA 2 Standard enclosures; surface-mounted panels must be sprinkler-proof.
- .5 Flush panels must have concealed hinges and flush type combination lock latch. Doors must open at a minimum of 135°. Trims must have fasteners concealed and must be prime coated to receive room finish paint.
- .6 Surface-mounted panels must have manufacturer's standard trim complete with lock and latch.
- .7 Panel locks must be common to one key throughout Project. Provide two (2) keys for each panel - keys alike.
- .8 Branch circuits shown with breakers must be rated for appropriate short circuit rating.
 - .1 250-V normal and essential system panelboards: Bus and breakers rated for 14 kA (symmetrical) interrupting capacity or as indicated. The most restrictive will apply.
 - .2 600-V normal and essential system panelboards: Bus and breakers rated for 35 kA (symmetrical) interrupting capacity or as indicated. The most restrictive will apply.
- .9 Circuit breakers requiring shunt trip coils must be as per drawing. Contractor must ensure that terminals for connecting power to shunt trip units are easily accessible in control compartment with marked terminal block. Detail must be notified on shop drawings.
- .10 Panels must have mains capacity and branch switches as shown. Bus-work in panels must be copper.
- .11 Panel bus and switch units must be designed to safely withstand indicated mechanical stresses and heating imposed by minimum symmetrical fault current.
- .12 Panel interiors must be factory assembled. They must be designed so that units are readily removable and interchangeable without modification to bus-work or mounting rails.
- .13 Panels must be complete with breaker sections, spares, and spaces, as shown. "Spares" must be understood to be complete breaker. "Spaces" must be understood to include necessary bus-work such that Owner, at a later date, need only buy breaker.
- .14 Provide a 0.24 in. (6 mm) thick laminated phenolic, cable entrance plate, as indicated.
- .15 Panels must be sectionalized, unless noted otherwise. Multi-section panels must have main cross-over solid bus bars. Main bus capacity of each section must be full size to match cross-over bus. Bus-work in panels must be copper. All phase and neutral busbars must have same rating.
- .16 Distribution panels must be of same manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements, manufacturer's nameplate must show fault- current that the panel, including breakers, has been built to withstand.
- .17 Panels must be painted in accordance to the building standards, obtain the latter from the building operating body:
 - .1 Orange for essential distribution panels
 - .2 Light blue for normal distribution panels.
- .18 Panels must be as manufactured by:
 - .1 Schneider Electric (FPE, Square-D).
 - .2 Eaton/Cutler-Hammer Canada.
 - .3 Siemens.
 - .4 GE.

2.02 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Provide nameplate for each panelboard, size 4, engraved.
- .3 Nameplate for each circuit in distribution panelboards, size 2, engraved.
- .4 Complete circuit schedule with typewritten legend showing location and load of each circuit, including room numbers.
- .5 Lamicoid labels, mechanically fastened, for all are to indicate the panel name, voltage, and must include an indication of the panel feeding it.

2.03 BREAKERS

- .1 Bolt-on, moulded case circuit breaker, quick-make, quick-break type for manual and automatic operation.
- .2 Common trip breakers with single handle for multi-pole applications.
- .3 All 600 V breakers to be equipped with lock-out provision for pad lock. Provide GFCI breakers, as indicated on drawings.

3 EXECUTION

3.01 GENERAL

- .1 Provide surface of flush-mounting distribution panel, as shown.
- .2 Mount tops of panels as specified in Section 26 05 01 – Common Work Results - Electrical.
- .3 Panels must be rigidly supported and must be square with building lines.
- .4 Connect loads to circuits.
- .5 Ensure panels have a 15% allowance in spare circuits.
- .6 Flush-mounted distribution panels must be fitted with four (4) 1-¹/₁₆ in. (27 mm) empty conduits from the tub to a 11-¹³/₁₆ in. x 11-¹³/₁₆ in. (300 mm x 300) mm accessible junction box in the ceiling space above complete with pull strings, for future expansion/renovation.

END OF SECTION 26 24 16

1 General

1.01 GENERAL REQUIREMENTS

- .1 This Section covers items common to all sections of Division 26, Instructions to Bidders, any Supplements and/or Addenda thereto form an integral part of this Specification and must be read in conjunction herewith.
- .2 Conform to requirements of Contract Documents.

1.02 SUMMARY

- .1 The following specifications detail the minimum performance and related criteria for occupancy sensors proposed for this project. Any deviations from this specification must be documented in writing and submitted to the Consultant prior to the issuance of any contracts and must also include all associated cost savings or additions, including but not limited to equipment, equipment installation, power wiring labor and materials, programming, documentation and project management.
- .2 ~~The device shall be compatible with the existing lighting control system.~~ Local line voltage lighting controls to be used.

1.03 SECTION INCLUDES

- .1 Provide, install and test occupancy sensors as specified herein for the areas indicated on the drawings.

1.04 RELATED SECTIONS

- .1 Section 26 05 00 (Common Work Results for Electrical).

1.05 REFERENCES

- .1 Underwriters Laboratories Inc. – UL508, UL916.
- .2 ISO 9001 Quality Standard
- .3 NOM Certification Mark
- .4 American National Standards Institute
- .5 Institute of Electrical and Electronic Engineers

1.06 SYSTEM DESCRIPTION

- .1 Permanently installed, wallbox mounted occupancy sensors
- .2 Permanently installed, wall mounted occupancy sensors
- .3 Permanently installed, ceiling mounted occupancy sensors
- .4 Permanently installed power packs.

1.07 APPROVALS

- .1 Prior approval is required for alternate proposals. For pre-approval, provide all the information listed under Submittals a minimum of ten (10) working days prior to initial bid date.

- .2 Complete Catalog data, specifications, and technical information on alternate equipment must be furnished to the Consultant and Owner at least ten business days in advance of the bid date.

1.08 QUALITY ASSURANCE

- .1 Manufacturer shall have a minimum of 10 years continuous experience with occupancy sensors.
- .2 Occupancy sensors shall be CUL listed and CSA approved. Manufacturer shall provide evidence of compliance on request.
- .3 Manufacturer shall have their quality system registered to the ISO 9001 Quality Standard, including in-house engineering for all product design activities. Due to the exclusion of the Design Control element, ISO 9002 Registration is not acceptable.
- .4 All devices shall be covered by a minimum one-year warranty.

1.09 PROJECT/SITE CONDITIONS

- .1 Lighting controls shall operate in an ambient temperature range of 0°C (32°F) to 40°C (104°F) and less than 90% non-condensing relative humidity without the requirement of a regularly scheduled maintenance program.

1.10 WARRANTY

- .1 The manufacturer shall provide a full one-year limited warranty on all equipment supplied. The warranty shall cover 100% of the parts and manufacturers labor costs required over the first year, which are directly attributable to the manufacturer. Warranty coverage shall begin on the date that the equipment is energized.

2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- .1 General Electric
- .2 LUTRON Electronics Co., Inc.
- .3 Watt stopper.
- .4 Pass Seymour.
- .5 Legrand.

2.02 PERFORMANCE

- .1 Occupancy Sensors shall turn off or reduce lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
- .2 Occupancy sensor shall accommodate all conditions of space utilization and all irregular work hours and habits.
- .3 Sensors shall be fully adaptive and adjust their sensitivity and timing to ensure optimal lighting control for any use of the space.
- .4 Sensors shall have optional readily accessible, user adjustable controls for time delay and sensitivity that can override any adaptive features.

- .5 Sensors shall utilize Infrared, Ultrasonic or Dual technology (Infrared and Ultrasonic) as its sensing mechanism.
- .6 Occupancy sensors using passive infrared technology shall have a multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
- .7 Occupancy sensors using ultrasonic technology shall have an operating frequency of 32kHz or 40kHz, that shall be crystal controlled to within plus or minus 0.005 tolerance to assure reliable performance and eliminate sensor cross talk. Sensors using multiple frequencies are not acceptable.
- .8 All sensors shall provide a method of indication to verify that motion is being detected during testing and that the unit is working. There shall be different indicators for Infrared and Ultrasonic technologies and both indicators shall be present on a dual technology sensor.
- .9 Sensors and power packs shall be UL94V-0 or UL94-5V rated respectively.
- .10 Controls shall incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.
- .11 Controls shall not be susceptible to damage or loss of memory due to static discharge.

2.03 CEILING AND WALL MOUNT SENSORS

- .1 Sensor shall be easily mounted to a standard acoustic ceiling tile or surface mounted, and all necessary mounting hardware and instructions shall be provided.
- .2 Ceiling mount sensors shall have viewing directions indicated on the mounting bracket allowing for ease of installation.
- .3 Wall mount sensors shall have a swivel mount base allowing for exact positioning of sensor.
- .4 Ceiling-Mount occupancy sensors using passive infrared technology shall have a customizable mask to block off unwanted viewing areas.
- .5 Sensors shall be Class 2 devices.
- .6 Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components to achieve this function are not acceptable.
- .7 Sensor shall have the ability to be put into an 8 second test mode to verify correct operation and coverage.

2.04 WALL SWITCHES

- .1 Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness.
- .2 Where specified, a bypass manual override on key shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- .3 Ultrasonic sensors shall have an on/off function accomplished by utilizing a mechanical air-gap switch to totally disconnect power from the load. During off condition, no leakage current shall be present at the fixture(s).

- .4 Contractor shall install all backboxes with a minimum wallbox depth of 2.5 inches.
- .5 Two circuit wall switches shall be able to support the full rated load on either of the circuits, and be able to switch them independently.
- .6 Sensor shall have the ability to be put into a test mode to verify correct operation and coverage.

2.05 SENSOR POWER PACKS

- .1 For ease of mounting, installation and future service, power pack(s) shall be able to mount through a 1/2 knock-out in a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer shall provide power to a minimum of three (3) sensors.
- .2 Power pack shall be plenum rated.
- .3 Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded CUL classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- .4 Provide sensor power packs to suit all applications.

3 EXECUTION

3.01 INSTALLATION

- .1 It shall be the contractor's responsibility to locate and aim sensory in the correct location required for a complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- .2 Contractor shall furnish all equipment, labor, system setup and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
- .3 Devices shall be installed utilizing manufacturer's recommended application, wiring and installation instructions.
- .4 Proper judgment shall be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitation or interference of structural components. The contractor shall also provide at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.02 FIELD QUALITY CONTROL

- .1 Manufacturer shall provide toll-free technical support hotline 24 hours per day, 7 days per week.
- .2 Supplemental information shall be provided by manufacturers Internet site.

- .3 Manufacturer shall offer upgraded warranty based upon successful field commissioning.
- .4 Manufacturer shall be capable of providing on-site service support within 24 hours anywhere in North America.
- .5 Manufacturer shall offer a renewable service contract on a year to year basis which will include parts and factory labor.

END OF SECTION 26 27 26.03

1 GENERAL

1.01 STANDARDS

- .1 CAN/CSA-C22.2 No. 144-M91 (R2015) - Ground Fault Circuit Interrupters.
- .2 CSA C22.2 No. 5-13 - Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit Breaker Enclosures.
- .3 Ontario Electrical Safety Code.

1.02 PRODUCT DOCUMENTATION

- .1 Submit and prepare shop drawings in accordance with Section 01 33 00 - Submittal Procedures. They must include details, such as dimensions, clearances required, cable entries, tabulation of all devices including tags, and wiring diagrams (power, signals, control wiring). The notes will identify field wiring and factory installed wiring.
- .2 Include time-current characteristic curves for breakers with ampacity of 150 A and over. In some cases, due to critical nature of the equipment, smaller size breaker may have to be verified for time current coordination as well.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance (O&M) data for circuit breakers for incorporation into manual.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 BREAKERS - GENERAL

- .1 Provide moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient, as indicated.
- .2 It is the responsibility of the supplier to ensure that a necessary study is carried out or professional judgment is sought before offering the breakers. This includes inrush from number of transformers that can be energized by single breaker.
- .3 Provide multi-pole breakers with a common-trip device and a single handle.

- .4 Provide circuit breakers with interchangeable trips, as indicated.
- .5 Provide pad locking devices on all breakers to lock the handle of a breaker in the "on" or "off" position with the trip units to remain free to function and protect the circuit from both overload and short circuit conditions.
- .6 With thermal and adjustable magnetic trip mechanisms on all ratings 125 A and larger.

2.02 MANUFACTURERS

- .1 Provide circuit breakers of one manufacturer. Acceptable manufacturers are:
 - .1 Schneider Electric.
 - .2 Cutler-Hammer Canada.
 - .3 Siemens.

3 EXECUTION

3.01 EXAMINATION

- .1 Examine the circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after satisfactory compliance.

3.02 IDENTIFICATION

- .1 Identify all field installed conductors, wiring and components; provide warning signs as required by manufacturer and the Ontario Electrical Safety Code.

3.03 CONNECTION

- .1 Install grounding connections, power wiring, and indication devices. Verify the torque recommended by manufacturer.

3.04 TESTS

- .1 Test for continuity of phase and ground connections and insulation resistance (Megger) for each phase to phase and phase to ground.
- .2 Any malfunctioning of the units must be corrected and retested to demonstrate compliance.

END OF SECTION 26 28 21

1 GENERAL

1.01 STANDARDS

- .1 Design, manufacture, and test all disconnect switches in accordance with good industry practice and in accordance with the following Standards and Codes:
 - .1 CAN/CSA Standard C22.2 No. 4-04 (R2014) - Enclosed and Dead-Front Switches.
 - .2 CSA Standard C22.2 No.39-13- Fuse Holder Assemblies.

1.02 PRODUCT DOCUMENTATION

- .1 Submit and prepare shop drawings in accordance with Section 01 33 00 - Submittal Procedures. They must include details, such as dimensions, clearances required, cable entries, tabulation of all devices including tags, and wiring diagrams (power, signals, control wiring). The notes will identify field wiring and factory installed wiring.

1.03 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance(O&M) data for fused and non-fused disconnect switches for incorporation into manual.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 DISCONNECT SWITCHES

- .1 Provide heavy-duty type fusible and non-fusible disconnect switches in CSA Enclosure to suit the environment where the switch is located.
- .2 Provide the provision for padlocking the switch in the "ON" and "OFF" switch position by up to three (3) locks.
- .3 Mechanically interlock the door with a voidable interlock to prevent the door opening when the switch handle is in the "ON" position.
- .4 Provide fuses of the size as indicated in accordance with low voltage fuses section.
- .5 Provide fuse holders, suitable without adaptors, for the size of the fuses, as indicated.

- .6 Provide a type A quick-make, quick-break switching action with arc chutes or arc snuffers.
- .7 Provide a vertically moving handle with an "ON-OFF" switch position indication on the switch enclosure cover with the "ON" position being the upper handle position.

2.02 EQUIPMENT IDENTIFICATION

- .1 Provide an equipment identification nameplate in accordance with Section 26 05 53 - Identification of Electrical Systems.

2.03 MANUFACTURERS

- .1 Provide disconnect switches which are the product of one (1) manufacturer. Acceptable manufacturers are:
 - .1 Federal Pioneer Limited.
 - .2 Cutler Hammer Canada.
 - .3 Square D Canada Electrical Equipment Inc.
 - .4 Siemens Canada.

3 EXECUTION

3.01 INSTALLATION

- .1 Install the disconnect switches, complete with fuses, as indicated.

END OF SECTION 26 28 23

1 GENERAL

1.01 REFERENCES

- .1 Canadian Standards Association (CSA International).
- .2 ICES-005-07, Radio Frequency Lighting Devices.
- .3 Underwriter's Laboratories of Canada (ULC).

1.02 WORK INCLUDED

- .1 This Section includes for supply and installation of luminaires, lamps, drivers, supports and accessories, and for supply of plaster frames, trim rings, and backboxes for plaster or drywall ceilings or concrete.

1.03 COORDINATION WITH OTHER SECTIONS

- .1 Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Owner and defer ordering until clarified.
- .2 Supply plaster frames, trim rings, and backboxes to other trades as the work requires.
- .3 Coordinate with Mechanical Contractor to avoid conflicts between luminaires, supports, fillings, and mechanical equipment.

1.04 APPROVAL OF ALTERNATIVES

- .1 Refer to Section 26 05 01.

1.05 SUBMITTALS

- .1 Samples of luminaires noted are required for approval prior to final production.
- .2 Construction and performance of luminaires, subject to approval of the Owner.
- .3 Provide, if requested by the Owner, complete photometric data and heat dissipation reports from independent testing laboratory.
- .4 Shop drawings for all luminaires showing all pertinent physical characteristics.

1.06 LUMINAIRE DESIGNATION

- .1 Refer to drawings for luminaire designations.

1.07 RECESSED LUMINAIRES

- .1 Install recessed luminaires to permit removal from below, to gain access to outlet or prewired luminaire box. Connect recessed luminaires to boxes with flexible conduit and approved luminaire wire.
- .2 Supply recessed luminaire complete with trim type required for ceiling system installed. Before ordering, confirm ceiling construction details and architectural finish for each area.

1.08 SAMPLE LUMINAIRES

- .1 Submit for approval of Owner one of each luminaire type, if requested, before manufacturing commences. If directed by Owner, set up luminaire to show coordination with ceiling, mechanical diffuser assemblies, and other equipment. Luminaire, if approved, will be retained as a control standard. Luminaires not approved to be resubmitted.
- .2 Alternate luminaires must have the same lighting characteristics, wattage, efficacy, and efficiency with same lumen output or improved conditions.
- .3 Dimensions and color finishing must be approved by the Architects.

1.09 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for transformers, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.10 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: submit operation and maintenance data for motor starters for incorporation into manual.

1.11 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated areas.
 - .2 Store materials and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 LED LIGHT SOURCES

- .1 LED luminaires must include circuit board mounted arrays of Class 1 high output LEDs and pre-wired LED driver modules.
- .2 Luminaires must be designed so that failure of one LED will not result in the loss of the entire luminaire. LED modules must be replaceable without replacement of the entire luminaire.
- .3 LED luminaires must be rated for a minimum operational life of 80,000 hours based on an average 10 hours per operation cycle at a temperature of 25°C. Lumen output depreciation must be less than 30% over the life of the LED.
- .4 Light output must have a color temperature range of 4,000 to 4,300 K with a color rendering index of 80 or greater.

- .5 LED luminaires must be designed with passive thermal management features of sufficient capacity to ensure the LED maximum junction temperature is not exceeded over the operating temperature range of -40°C to + 40°C.
- .6 LED luminaires must be rated to operate on a 120 V system at 60 Hz with a power factor of 0.9 or greater and THD of less than 10% over the entire load range of 0-100%.
- .7 LED luminaires must be equipped with on-board surge suppression devices to withstand transient peak voltages up to 10 kV and transient peak currents up to 4 kA. Surge protection devices must fail to the "luminaire inoperable" state.
- .8 LED luminaires must meet FCC 47 CFR Part 15 / Class A emission limits.
- .9 All photometric data must be measured by the latest Edition of the IESNA LM-79.
- .10 The LED lumen maintenance characteristics must be measured in accordance with the latest Edition of IESNA LM-80 "Approved Method for Lumen Maintenance Testing of LED Light Sources." Submit copy of manufacturer's LM-80 report accompanied by lumen depreciation estimates for 10, 15, and 25°C luminaire ambient operating temperatures.
- .11 The power supply driver enclosure must be sealed to protect against the entry of dust and water (minimum ingress protection level of 65 (IP65)).
- .12 The power supply driver for interior LED luminaires must be compatible with ecosystem network.

2.02 FINISHES

- .1 Light fixtures finish and construction to meet ULC listings and CSA certification related to intended installation.

3 EXECUTION

3.01 GENERAL INSTALLATION

- .1 Locate luminaires as indicated
- .2 Support luminaires directly from building structure to comply with seismic restraints section.
- .3 Recessed downlights installed in T-bar ceilings must be secured to metal support blocking (metal stud) spanning between ceiling grid members. Secure recessed downlight to blocking to ensure that luminaire does not move when trim is adjusted.
- .4 Recessed lighting luminaires in inaccessible ceilings must be secured to blocking attached to building structure.
- .5 Coordinate installation of luminaires with mechanical trades to avoid conflicts between luminaires and mechanical system components.
- .6 All luminaires must be installed level and in-line. Luminaires shown in continuous rows or broken lines must be aligned so that all rows appear as straight lines. Luminaires installed crooked will not be accepted.

END OF SECTION 26 50 00

1 GENERAL

1.01 GENERAL

- .1 This section of the specification shall be read in conjunction with and be governed by the requirements of Electrical Specification.

1.02 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Electrical Specifications.
- .2 Data shall indicate system components, mounting method, source of power and special attachments.

1.03 WARRANTY

- .1 Refer to Electrical Specifications regarding requirements.

2 PRODUCTS

2.01 EQUIPMENT

- .1 Supply voltage: as noted in plans.
- .2 Output voltage: 12 V DC.
- .3 Operating time: 30 min. Provide units of a capacity to operate loads detailed on drawings. Plus spare capacity of 25%.
- .4 Battery: sealed, ten (10) year life, maintenance free.
- .5 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected and modular constructed.
- .6 Solid state transfer.
- .7 Low voltage disconnect solid state, modular, operates at 80% battery output voltage.
- .8 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.
- .9 Battery units shall be complete with unit mounted or remote 7 W MR16 LED units, Model MQM1/MQM2 Series, identified as Types R1/R2 respectively on plans.
- .10 Luminaire remote heads: White.
- .11 Cabinet: suitable for direct or shelf mounting to wall and complete with knockouts for conduit.

- .12 Auxiliary equipment:
 - .1 Ammeter
 - .2 Voltmeter
 - .3 Lamp disconnect switch
 - .4 Test switch
 - .5 Time delay relay
 - .6 Battery disconnect device
 - .7 AC input and DC output terminal blocks inside cabinet.
 - .8 Bracket
 - .9 Cord and 5-15P plug for AC connection.
 - .10 RFI suppressors.
 - .11 Provide automatic self-diagnostic circuiting.

2.02 MANUFACTURER

- .1 Lumacell;
- .2 Beghelli;
- .3 Emergi-lite.
- .4 Aimlite.

3 EXECUTION

3.01 INSTALLATION

- .1 Install unit equipment for emergency lighting in accordance with CSA C22.2-141, 10 (R2015) Emergency Lighting Equipment and the Canadian Electrical Safety Code, latest Edition.
- .2 Install unit equipment and remote mounted fixtures as indicated.
- .3 Coil and wrap excess cordset neatly.
- .4 Direct heads as indicated on site by the Consultant and/or authority having jurisdiction.
- .5 Conductors to remote lamps shall be sized for a maximum voltage drop of 5% of the rated unit output voltage, measured at the lamp terminals. Conductors shall be in conduit.

END OF SECTION 26 52 10

1 General

1.01 SECTION INCLUDES

- .1 Provision of materials and installation of exit signs.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 National Building Code of Canada (NBCC) 2010, Division B, Part 3.4.5.
 - .2 CSA C22.2 No.141-02(R2007), Unit Equipment for Emergency Lighting
 - .3 CSA C860-07, Performance of Internally Lighted Exit Signs.

1.03 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 Products

2.01 STANDARD UNITS

- .1 Green Pictogram Exit Signs to NBCC 2010.
- .2 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .3 Housing: extruded aluminum housing.
- .4 Face and back plates: white finish.
- .5 Voltage: Multi-voltage – Input 120V
- .6 Lamps: LED.
- .7 Operation: designed for over 100,000 hours of continuous operation without relamping.
- .8 Illuminated faces shall provide evenly illuminated green and white legend.

2.02 DESIGN

- .1 Universal mounting.
- .2 Single-face or double-face as indicated.
- .3 Pictogram Signage:
 - .1 Where exit sign symbol on plans have no arrow, provide Pictogram "Straight From Here" signage.
 - .2 Where exit sign symbol on plans show left arrow, provide Pictogram "Left From Here" signage.
 - .3 Where exit sign symbol on plans show right arrow, provide Pictogram "Right From Here" signage.
 - .4 Where exit sign symbol on plans show left and right arrows on the same face, provide two pictograms: one "Left From Here" and one "Right From Here".

3 Execution

3.01 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.02 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NBCC standard and local regulatory requirements.
- .2 Connect signs to dedicated exit light circuits.
- .3 Ensure that exit light circuit breaker is locked in on position.

3.03 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION 26 53 00

1 GENERAL

1.01 GENERAL DESCRIPTION

- .1 To provide guidelines of work and Codes associated with communications devices, cabling, connections, equipment, and documentation.

1.02 REFERENCES

- .1 All work, equipment, and systems will be manufactured, provided, repaired, installed, and tested in accordance with the latest Edition and all current amendments of the applicable publications and Standards of the organizations listed below as of the date of the Contract Documents. When the Specification requirements exceed the requirements of these publications and Standards, the Specifications will govern:
- .1 ANSI/TIA/EIA 569-B, Commercial Building Standards for Telecommunications Pathways and Spaces.
 - .2 ANSI/TIA/ 606-B, The Administration Standard for the Telecommunications Infrastructure of Commercial Building.
 - .3 ANSI/J-STD-607, A Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - .4 ANSI/TIA/EIA-862, Building Automation Systems Cabling Standard for Commercial Buildings.
 - .5 ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers.
 - .6 ASTM D 4566-05, Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable, 2005.
 - .7 BICSI, Telecommunications Distribution Methods Manual (TDMM) ,13th Edition.
 - .8 BICSI, Information Transport Installation Manual (ITSM), 5th Edition.
 - .9 CAN/CSA-C22.2 No. 60950-1-07 – Information Technology Equipment – Safety - Part 1 – General Requirements (Bi-National Standard with UL60950-1).
 - .10 CAN/CSA-C22.2 No. 62368-1:12, Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements (Bi-National Standard, with UL 62368-1).
 - .11 CAN/CSA-ISO/IEC 18010-04, Information Technology – Pathways and Spacers for Customers Premises Cabling (Adopted ISO/IEC 18010-2002, first Edition, 2002-05).
 - .12 CAN/CSA-ISO/IEC 11801-04 – I, Information Technology – Generic Cabling for Customer Premises (Adopted ISO/IEC 11801, 2002, Second Edition, 2002-09).
 - .13 CAN-CSA-ISO/IEC TR 24704-06, Information Technology – Customer Premises Cabling for Wireless Access Points (Adopted ISO/IEC TR 24704-2004, first Edition, 2004-07).
 - .14 IEEE 802.3, Standard for Information Technology -Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks – Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
 - .15 ISO/IEC, 11801, Information Technology – Generic Cabling for Customer Premise.
 - .16 Local Authority Having Jurisdiction.
 - .17 NFPA 262, Flame Travel and Smoke of Wires and Cables.
 - .18 TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises.
 - .19 TIA-568-C.1, Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements.
 - .20 TIA-568-C.3, Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard.

- .21 TIA-568.2-D, Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components.
- .22 UL 1666, Standard for Safety of Flame Propagation Height.

1.03 DEFINITIONS / TERMS / ACRONYMS

- .1 ANSI – American Northern Standards Institute.
- .2 AWG – American Wire Gauge.
- .3 BICSI – Building Industry Consulting Service International.
- .4 EIA – Electronics Industry Alliance.
- .5 ETL – Intertek Semko Labs.
- .6 IDC – Insulation Displacement Contact.
- .7 IEC – International Electrotechnical Commission.
- .8 IEEE – Institute of Electrical and Electronic Engineers.
- .9 ISO – International Standards Organization.
- .10 J-STD – Joint Standard.
- .11 NFPA – National Fire Protection Agency.
- .12 SC – Subscriber Channel.
- .13 TIA – Telecommunications Industry Association.
- .14 UL – Underwriters Laboratory.
- .15 1G Base-T – Networking protocol capable of transmitting 1 billion bits of information per second over copper twisted pair.
- .16 10G Base-T – Networking protocol capable of transmitting 10 billion bits of information per second over copper twisted pair.
- .17 10G Base-SX – Networking protocol capable of transmitting 10 billion bits of information per second over optical fiber at 850 nanometers.
- .18 Words in the singular will also mean and include the plural, wherever the context so indicates, and words in the plural will mean the singular, wherever the context so indicates.
- .19 Cabling: The term “cabling” will mean cable assembly, raceway, conductors, fittings, and any other necessary accessories to make a complete wiring system.
- .20 Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms or floor distribution terminals, entrance facilities, and equipment rooms within or between buildings.
- .21 Backbone Cabling: Cabling and connecting hardware providing interconnections between telecommunications rooms, equipment rooms, and entrance facilities.
- .22 Horizontal Cabling: The cabling between and including the work area outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room.
- .23 Telecommunications: A branch of technology concerned with transmission, emission, and reception of signs, signals, writing, images, and sounds; that is of any nature by cable, radio, optical, or other electromagnetic systems.

- .24 Pull Point: A Pull Point is a space used to transition between floors for backbone and horizontal cabling within a building riser system.
- .25 Equipment Outlet (EO): A device also known as the outlet or information outlet placed at the user workstation for termination using connectors (jacks) of horizontal media for connectivity of data and voice at teacher work area outlet, multimedia equipment. These outlets provide the connection point to voice, data, and other media services.
- .26 Connector 8P8C (Jack): A female connector having eight positions and eight conductors. Jacks are typically used to terminate eight conductor category rated cable at the user end and are inserted into faceplates to create a connection point for the user's equipment cord.

1.04 SUBMITTAL REQUIREMENTS

- .1 Under the provisions of this request for proposal, prior to the start of work the Structured Cabling System Contractor will:
 - .1 Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
 - .2 Submit proof from Manufacturer of Contractor's good standing in Manufacturer's program.
 - .3 Submit appropriate cut sheets and samples for all products, hardware and cabling.
- .2 Work will not proceed without the Owner's approval of the submitted items.
- .3 The Structured Cabling Systems Contractor will receive approval from the Owners on all substitutions of material. No substituted materials will be installed, except by written approval from the Owner.
- .4 Refer to other applicable Sections for additional submittals requirements.

1.05 CONTRACTOR QUALIFICATIONS

- .1 Comply with qualification requirements hereafter.
- .2 The Installer (Firm and Employees) will be experienced in the operations they are engaged to perform. Demonstrate at least five years of continuous recent experience on similar projects. The Installer will hold recent, up-to-date licenses, certifications, and training certificates in the area the project is located and for the equipment to be installed.
- .3 Qualified Structured Cabling System Installation firms will have demonstrable design and installation training with certifications of competence. Certified training will be industry recognized and at least equal to:
 - .1 Building Industry Consulting Service International, Inc. (BISCI) Registered Installer.
 - .2 Registered Communications Distribution Designer (RCDD).
 - .3 Certified Installer of proposed system.
- .4 Provide a full-time on-site foreman who personally has been certified as described above. Submit all documentation under this Section.
- .5 Provide an on-call Project Manager to supervise the Project.
- .6 Each Foreman and Installer working on this Project will be trained to the qualified level as specified by the Manufacturer(s) for installation and maintenance of equipment being provided on this Project. The training will consist of at least a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each Foreman and Installer working on this Project will have documentation from the Manufacturer indicating that they

have been adequately trained prior to the start of the Project. Only Foreman and Installers who have been properly trained and documented by the Manufacturer whose equipment is being provided on this Project will be allowed to install same.

- .7 Separate Qualifications Requirements:
 - .1 Installers will be specifically qualified for each system being installed under this section. Provide documentation for each installer including:
 - .1 Training Certificates from the manufacture being installed.
 - .2 Registered Telecommunications Installer Apprentice Certificate.
 - .2 Maintain, at the site, an updated copy of the Manufacturer Trained Installers list, including a copy of their training documentation from the Manufacturer. This documentation will be made available to the Engineer upon request.

1.06 DELIVERY, STORAGE, AND PROTECTION

- .1 Contractor must ensure that materials delivery to work area must be coordinated with Construction Site Manager responsible for materials distribution to all trades.
- .2 Contractor is responsible for all materials, tools, and vehicles left onsite.
- .3 Contractor must coordinate a disposal bin for the removal of all trashes produced by the Contractor's associated personnel during the Project.
- .4 Contractor must ensure materials are stored in an environmental area where:
 - .1 Temperature does not exceed 50°C nor below 0°C.
 - .2 Humidity does not exceed 80%.
 - .3 No direct exposure to sunlight.
- .5 Cable must be stored according to Manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 5°C, the cable must be moved to a heated (10°C minimum) location. If necessary, cable will be stored off site at the Contractor's expense.
- .6 Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids, and wrap for protection.
- .7 Inspect and report concealed damage to carrier within specified time.
- .8 Store in a clean and dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of the Manufacturer. Location will be protected to prevent moisture from entering enclosures and material.
- .9 Handle in accordance with the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
- .10 The equipment racks and related accessories will always be kept upright. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer will be required to brace the equipment suitably to ensure that the tilting does not impair the functional integrity of the equipment.

1.07 PROJECT CONDITIONS

- .1 Environmental Requirements.
 - .1 Contractor must ensure that any pollutants produced during the work are disposed of according to local, provincial, or national regulations. Follow the most stringent guidelines.
 - .2 It is preferred that the Communications Contractor recycle any used or un-used components during the Construction Project.
- .2 Existing Conditions.
 - .1 New systems are being installed redundant to existing systems. Existing systems to stay operational until operational confirmation of the new systems cutover.

1.08 SEQUENCING

- .1 Cooperation and coordination with other trades.
 - .1 The work will be so performed that the progress of the entire building construction, including all other trades, will not be delayed and not interfered with. Materials and apparatuses will be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.
 - .2 Keep fully informed as to the shape, size, and position of all openings required for all apparatuses and give information in advance to build openings into the work. Provide and set in place all sleeves, pockets, supports, and incidentals.
 - .3 Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements will be made at no additional costs.
 - .4 Structural elements of the project will not be relocated, altered, or changed to accommodate the work without written authorization from the Owner/Engineer.
 - .5 Work that is installed before coordination with other trades or that causes interference with the work of other trades will be changed to correct condition at no additional cost to the Owner.
 - .6 Attend project coordination meetings to coordinate work of this Section, pathways, work of other trades, phasing, and other project requirements.

1.09 CONTINUITY OF SERVICE AND SCHEDULING OF WORK

- .1 Continuity of all services will be maintained in all areas that will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such will be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner will designate. The Contractor will schedule the shutdown with seven-day advance notice, arranging work to minimize shutdown time.
- .2 Should services be inadvertently interrupted, immediately notify the Owner. Be prepared to immediately provide labor, materials, and equipment necessary for prompt restoration of interrupted service.
- .3 Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Engineer, Owner, other Trades, and the General Contractor.
- .4 It is the contractors' responsibility to remove and dispose of all abandoned low voltage cables from plenum spaces, floor cavities, cable tray, and conduit.

1.10 PROTECTION OF WORK AND PROPERTY

- .1 Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.
- .2 Protect all equipment and materials from damage from all causes, including theft. All materials and equipment damaged or stolen will be replaced with equal material or equipment at the option of the Engineer and Owner.
- .3 Materials and equipment stored for this Project will be protected and maintained according to the Manufacturer's recommendations and requirements.
- .4 Protect all equipment, outlets, and openings with temporary plugs, caps, and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
- .5 Use caution to avoid damage to existing work and to prevent harm to personnel working in all areas.
- .6 Coordinate installations with all other trades in order to not damage equipment or cables during construction. Any work that is damaged during construction will not be repaired. Replace damaged work completely, with no splices in cabling, at no additional cost to the Owner.

2 PRODUCTS

2.01 COMMUNICATIONS HORIZONTAL CABLING

- .1 Refer to Section 27 05 00.

2.02 GENERAL

- .1 Do not install equipment and materials which have not been reviewed by the Engineer. Equipment and materials which are installed without the Engineer's review or without complying to comments issued with the review, will be removed from the Project when so instructed by the Engineer. No payment will be made for unapproved or removal if it is ordered removed. The Installer will be responsible for any ancillary costs incurred due to its removal and the installation of the correct equipment and materials.
- .2 Obtain detailed information on installation requirements from the Manufacturers of all equipment to be furnished, installed or provided. At the start of construction, verify all Contract Documents, including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service, and verify electrical characteristics of equipment prior to roughing.
- .3 Equipment and systems will not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- .4 Any and all material installed, or work performed in violation of above requirements, will be re-adjusted and corrected by the Installer without charge.
- .5 Refer to all Drawings associated with the Project prior to the installation or roughing-in of the electrical outlets, conduit, and equipment, to determine the exact location of all outlets.
- .6 After installation, equipment will be protected to prevent damage during the construction period. Openings in conduits and boxes will be closed to prevent the entrance of foreign materials.

- .7 All connections to equipment will be made as required, if applicable, and in accordance with the approved submittal and setting drawings.
- .8 Work includes field survey of existing conditions, systems, equipment, and tracing of existing circuits in order to determine scope of work.
- .9 Always maintain the existing building in operation during the entire construction period. If it is necessary to have a system shutdown, a written request for approval will be submitted in advance stating the estimated shutdown time. Work will be planned to minimize shutdown. Shutdowns will be at the convenience of the Owner and, if necessary, on premium time.
- .10 Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

2.03 CABLE PATHWAYS

- .1 Install cables in pathways.
- .2 Provide all termination equipment and cabling for a complete installed operating system. Pathways, outlet boxes, and grounding.
- .3 All pathways provided under this Section will comply with fill capacities as per Code, TIA 569-B.
- .4 Cable bending radius will not be less than minimum required by TIA Standards and cable Manufacturer.
- .5 All cables will be installed in a neat and workman-like manner. Cables will be installed parallel and perpendicular to building elements.
- .6 Provide expansion fittings and adequate cable slack at all building expansion joints.
- .7 Fire/smoke seal all conduits, raceways, sleeves, slots, etc., where cables pass from one location to another through a rated assembly. Refer to Section 27 05 00 for Firestop penetrations.

2.04 WORK AREA OUTLETS

- .1 All work area outlet locations will be as indicated on Drawings. Uniquely label each work area outlet and jack within the outlet according to the numbering convention outlined in the section on labeling.
- .2 Labeling must be sequential in order, do not reuse a number throughout the entire infrastructure. Labeling convention to be confirmed by the Owner prior to installation.
- .3 Work area outlets installed in casework will have their cables installed within the conduit or raceway provided.
- .4 Work area outlets will be seated properly and will be installed level on walls and parallel to building elements as required.
- .5 A "gang box" combining data and power receptacle is acceptable to be placed in a location agreeable to the Consultant.

2.05 INSTALLATION PRACTICES

- .1 Follow and adhere to installation practices specified by the applicable Telecommunications Industry Association Standards.

- .2 Follow and adhere to installation practices specified by BICSI Information Transport System Installation Manual – latest Edition.
- .3 Follow and adhere to installation practices specified by BICSI Telecommunications Distribution Methods Manual – latest Edition.
- .4 Follow and adhere to installation practices specified by CSA C22.1, Canadian Electric Code Part 1, Latest Edition.
- .5 Follow and adhere to installation practices specified by the Manufacturers.
- .6 The general topology will be a "hierarchical star" configuration. All segments will originate in modular patch panels located in the telecommunications equipment racks/cabinets and end at the work area outlets.
 - .1 Routing:
 - .1 All cabling will be installed in conduit or in cable tray.
 - .2 Cables will be routed, in large groups, down main cable pathways, until a direct path to the point of access to the workstation outlet can be taken. At that point, cables will be routed, above all building systems, to the outlet location in accordance with standard installation practices, as described herein.
 - .3 Multiple cables to individual rooms will be pulled as a bundle and terminated at each end in sequential order so that labeling within a room location is in sequence.
 - .4 Cable routes will be with 90-degree angles whenever possible. Cables will not be installed randomly or diagonally through the building.
 - .5 Cables installed partially or fully within the telecommunications room will be routed through and secured in the cable tray wherever possible. No cables are to be routed across the rooms at angles nor are the cables to be run from one portion of the room or tray to another. Cables placed in the cable tray are to be laced frequently to keep them neatly bundled and not permitted to shift from one side of the tray to the other as they are routed in the tray.
 - .6 Horizontal cables will be routed to fixed wall locations through EMT to back box. Secure and store a maximum of 4 feet of slack cable in cable tray above ceiling at cable entrance to EMT.
 - .2 Separation from EMI Sources:
 - .1 Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - .2 When cables are required to cross power wiring, they will only do so perpendicular to the power wiring. Communications cable and power wiring will only cross each other the minimal number of times as required due to building design limitations.
 - .3 Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment will be as follows:
 - .1 Electrical equipment rating Less than 2 kVA: A minimum of 6 in. (127 mm).
 - .2 Electrical equipment rating between 2 and 5 kVA: A minimum of 12 in. (300 mm).
 - .3 Electrical equipment rating more than 5 kVA: A minimum of 24 in. (610 mm).
 - .3 Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment will be as follows:
 - .1 Electrical equipment rating less than 2 kVA: A minimum of 2-½ in. (64 mm).

- .2 Electrical equipment rating between 2 and 5 kVA: A minimum of 6 in. (150 mm).
- .3 Electrical equipment rating more than 5 kVA: A minimum of 12 in. (300 mm).
- .4 Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures will be as follows:
 - .1 Electrical equipment rating less than 2 kVA: No requirement.
 - .2 Electrical equipment rating between 2 and 5 kVA: A minimum of 3 in. (76 mm).
 - .3 Electrical equipment rating more than 5 kVA: A minimum of 6 in. (150 mm).
- .5 Separation between communications cables and electrical motors and transformers, 5 kVA or HP and larger: A minimum of 48 in. (1,200 mm).
- .6 Separation between communications cables and fluorescent fixtures: A minimum of 6 in. (127 mm).
- .7 All cables will have both ends completely terminated at their respective patch panel and work area outlet. Individual conductors will be trimmed flush with IDC block. Cables indicated to be "spare" will have one end terminated at their respective patch panel or cross-connect block and the other end will be hermetically sealed with a polyolefin heat-shrinkable cap.

2.06 LABELING

- .1 Labeling procedure will meet EIA/TIA 568C, 606-B (Class 2 Administration) and BICSI Standards.
- .2 Confirm the Hospital's existing labelling scheme. If desired by Hospital IT, the Contractor must continue the existing labelling scheme into the new hospital. IT may elect to implement a new scheme. The Contractor must allow for time to develop a new TIA-606B based scheme for implementation for new data drops installed by this Contractor.
- .3 Labeling must be sequential in order, do not reuse a number throughout the entire infrastructure.
- .4 Hand-written and embossed type labels are specifically prohibited. In addition, provide the following:
 - .1 Label each outlet with permanent self-adhesive label with minimum $\frac{3}{16}$ in. high characters.
 - .2 Label each cable and label all cables 6 inches from the connector at each end with permanent self-adhesive label with minimum, $\frac{1}{8}$ in. high characters, in the following locations:
 - .1 Inside receptacle box at the work area.
 - .2 Behind the communication room patch panel or punch block.
 - .3 Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications room location that is specific to the facilities terminated therein.
 - .4 Use color-coded labels for each termination field complying with ANSI/TIA -606B Standard color codes for termination blocks.
 - .5 Mount termination blocks on color-coded backboards.
 - .6 Labels will be machine printed. Hand-lettered labels will not be acceptable.
 - .7 Use industry standard TIA and BICSI color codes as specified herein and maintain consistent color-coding throughout the building.

2.07 CABLE SUPPORTS

- .1 Provide hook and loop (Velcro) cable wraps at all panels, equipment racks, and cabinets. Tie wraps are specifically prohibited.
- .2 Velcro wraps for horizontal cables will be secured with minimum required compression in order to secure the cables properly without impeding the signal transmission rating (geometry) of the cable.

2.08 CABLE PROTECTION

- .1 Provide bushings in all metal studs and the like where cables will pass through. Bushings will be of two-piece construction with one piece inserted through the opening and the second piece locking it into place. Single-piece bushings with locking tabs or friction fit are specifically prohibited.
- .2 Cables to be installed in existing enclosed open bays or furred spaces, where conduit stubs are not provided, will be protected from chafing or any damage. The Installer will verify that the warranty will not be violated before installing any cabling in these locations.
- .3 Provide cutting, coring, sleeves, and bushings and seal as required at all penetrations.
- .4 Cables damaged during installation will not be repaired. They will be completely replaced with new cable at no cost to the Owner.

2.09 DOCUMENTATION

- .1 Label all equipment as herein specified.
- .2 Provide:
 - .1 Provide Building Structured Cabling Systems Administration Report identifying TIA - 606B required information.
 - .2 Soft and hard copies documentation of test results for every cable segment and link in 3-ring binder. Documents will include measured values as well as whether or not the test passed.
 - .3 "Record" drawings indicating location of all equipment, including, but not limited to, work area outlets, patch panels, cross connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.
 - .4 Record drawings indicating actual cable routes and outlet identifiers. Provide respective copies mounted in each telecommunications room, and the main cross connect.
- .3 Submit manufactures certification that the structured cabling system installed meets the transmission requirements of TIA-568-C.0.

2.10 CUSTOMER TRAINING

- .1 As a minimum, training sessions to be provided will consist of the following:
 - .1 General project information and review will be by the General Foreman or Superintendent of the Trade.
 - .2 Specific system training will be by a Factory Trained Representative.
 - .3 Provide a complete review of the Project and systems including, but not limited to, the following:
 - .1 Review each Record Drawing (use of typical is acceptable).
 - .2 Note equipment layouts, locations, and control points.
 - .3 Review each system.
 - .4 Review system design operation and philosophy.

- .5 Review alarms and necessary responses.
- .6 Review standard troubleshooting techniques for each system.
- .7 Review areas served by equipment.
- .8 Identify color codes used.
- .9 Review features and special functions.
- .10 Review maintenance requirements.
- .11 Review operation and maintenance manuals.
- .12 Respond to questions (record questions and answers).
- .4 After training, walk the entire Project, review each equipment room and typical locations. Explain equipment and proper operation.
- .2 During the instruction period the Owner and Maintenance Manual will be used and explained.
- .3 The Owner and Maintenance Manual material will be bound in 3-ring binders and indexed. On the edge of the binder, provide a clear see-through plastic holder with a typed card indicating Project name, Engineer's name, Installer's name, and Volume number (e.g., Vol. No.1 of 2).
- .4 Provide name, address, and telephone number of the Manufacturer's representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.
 - .1 Include copies of Manufacturer's and installer's warranties and maintenance contracts, contact information, and performance bonds properly executed and signed by an authorized representative.
 - .2 Include copies of all test reports and certifications.
- .5 Training time should allow for a min of 3 hours for up to six (6) people.

2.11 CLEANING

- .1 In all telecom room spaces - a thorough sweeping, vacuuming, and wet mopping must be performed on a weekly basis or more frequently as directed by the Owner until Project completion. Cleaning must include floors, rafters, floor joists, exposed structural members, exposed mechanical/electrical equipment and ductwork/piping/conduits, walls, ladder trays, tops of cabinets/racks, existing/new passive, and active components, or per Manufacturer recommendations.
- .2 All cable managers and snap covers must be wiped clean, both inside and outside of front, including rear channels. All clear covers and doors must be cleaned, both front and rear, per Manufacturer recommendations.
- .3 Inside of fiber optic enclosure and patch panels must be wiped clean of settled dust. Cleaning must be performed for all new construction projects or where gypsum sanding has been performed.
- .4 All scraps, boxes, spools, pull-line, and trash must be removed and properly disposed of.
- .5 All residual cable lubricant must be cleaned from floors and walls with an appropriate degreaser.
- .6 Final cleaning to be completed after testing and commissioning.

2.12 PROJECT CLOSEOUT

- .1 Provide close out submittals as required herein and include the following close out submittals.
 - .1 Operation and Maintenance (O&M) Manuals.

- .2 Record Drawings.
- .3 Test Reports.
- .4 Warranty certification form Manufacturers.
- .5 Extra Materials.
- .6 Provide factory calibration report of field test equipment.
- .2 Obtain written receipts of acceptance close out submittals submitted. Receipts will specifically detail what is being delivered (description, quantity, and specification section) and will be dated and signed by firm delivering materials and by the Owner's Representative.
- .3 Provide record drawings indicating actual cable routing and cable terminations including all required identifiers.
- .4 Provide a half size set of drawings wall mounted in the Main Equipment Room.

END OF SECTION 27 00 00

1 General

1.01 SUMMARY

- .1 Scope:
 - .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
 - .2 Provide a complete and operational communications system as required by the drawings and as herein specified.
 - .3 Provide all labour, materials, tools, and equipment required for the complete installation of work called for in all sections of the Contract Documents.
 - .4 Perform all telecommunications work in accordance with the latest edition of the following standards, complete with all associated addendums and TSBs. In the following standards, where the word "should" is used, substitute the word "will".

1.02 REFERENCES / STANDARDS

- .1 American Society of Testing Materials (ASTM).
- .2 ANSI/ICEA S-83-596 Indoor Optical Cables – Single Mode.
- .3 ANSI/TIA/EIA 492CAAA Fibre Specifications.
- .4 ANSI/TIA/EIA 604-2 FOCIS 2 Fibre Optic Connector Intermatability Standard.
- .5 ANSI/TIA/EIA 604-3 FOCIS 3 Fibre Optic Connector Intermatability Standard.
- .6 ANSI/TIA/EIA-942a Telecommunications Infrastructure Standards for Data Centres.
- .7 ANSI/TIA/J-STD-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .8 ANSI/TIA-1152: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling.
- .9 ANSI/TIA-455-B Standard Test Procedures for Fibre Optic Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fibre Optic Components.
- .10 ANSI/TIA-526-14-A (OFSTP-14) Measurement of Optical Power Loss of Installed Multimode Fibre Cable Plant.
- .11 ANSI/TIA-526-7 (OFSTP-7) Measurement of Optical Power Loss of Installed Singlemode Fibre Cable Plant.
- .12 ANSI/TIA-568-C.0 Generic Telecommunications Cabling Standard for Customer Premise.
- .13 ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard.
- .14 ANSI/TIA-568-C.2 Balanced Twisted Pair Telecommunication Cabling & Components Standard.
- .15 ANSI/TIA-568-C.3 Optical Fibre Cabling & Components Standard.
- .16 ANSI/TIA-569-C Commercial Building Standard for Telecommunications Pathways and Spaces.
- .17 ANSI/TIA-598 Optical Fibre Cable Color Coding.
- .18 ANSI/TIA-606-B Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

- .19 ASTM D4566 Performance Measurements for 100 Ohm Twisted Pair Cables.
- .20 BICSI: Information Transport Systems Installation Methods Manual (ITSIMM – Latest Edition).
- .21 BICSI: Network Design Reference Manual – (Latest Edition).
- .22 BICSI: Outside Plant Design Reference Manual (OSPDRM – Latest Edition).
- .23 BICSI: Telecommunications Distribution Methods Manual (TDMM - Latest Edition).
- .24 Canadian Electrical Code (CEC - Latest Edition).
- .25 CENELEC EN 50173 Performance Requirements for Generic Cabling Schemes.
- .26 CSA - T527 Bonding and Grounding for Telecommunications in Commercial Buildings.
- .27 CSA - T528 Telecommunications Administration Standards for Commercial Buildings.
- .28 CSA - T529-95 Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.
- .29 CSA - T530 Commercial Building Standard for Telecommunications Pathways and Spaces.
- .30 CSA C22.1-09 Canadian Electrical Code, Part-1: Safety Standard for Electrical Installation.
- .31 IEC 603-7, Part 7 6 & 8 Pin Connector Specification Details.
- .32 IEC 874-1 Generic Specification for Fibre Optic Connectors and Cables.
- .33 Institute of Electrical & Electronic Engineers (IEEE).
- .34 ISO/IEC IS 11801A Generic Cabling for Customer Premises.
- .35 IT&T and ESS Standards.
- .36 Manufacturers Datasheets & Installation Guidelines.
- .37 National Building Code of Canada (NBC - Latest Edition).
- .38 National Electrical Manufacturers Association (NEMA).
- .39 Telecordia GR-326-CORE Generic Requirements for Single Mode Optical Connectors and Jumper Assemblies (formerly BELCORE).
- .40 TIA TSB-162 Telecommunications Cabling Guidelines for Wireless Access Points.
- .41 TIA/EIA – 598-A Optical Fibre Cable Colour Coding.
- .42 TIA/EIA – 729 Technical Specifications for 100 Ohm Screened Twisted Pair Cabling.
- .43 TIA/EIA – 758 Customer-Owned Outside Plant Telecommunications Cabling Standard.
- .44 TIA/EIA – TSB 67 UTP End-to-End System Performance Testing.
- .45 TIA/EIA – TSB 72 Centralized Optical Fibre Cabling Guidelines.
- .46 TIA/EIA – TSB 75 Additional Horizontal Cabling Practices for Open Offices.
- .47 TIA/EIA-455-59 Measurements of Fibre Point Defects Using an OTDR.
- .48 TIA/EIA-455-61 Measurement of Fibre or Cable Attenuation Using an OTDR.
- .49 TIA-604-5-C "Fibre Optic Connector Interchangeability Standard (FOCIS), Type MPO, FOCIS-5".

1.03 WORK INCLUDED

- .1 Conform to the requirements of the Owner, which applies to and forms part of all sections of the work.
- .2 Read and comply with all sections of this document. This section covers items common to all sections of Division 27; Instructions to Bidders, any Supplements and/or Addenda thereto form an integral part of this specification and must be read in conjunction herewith.
- .3 Provide communications components and accessories which may not be specifically shown on the drawings or stipulated in the specification but are required to ensure complete and operational systems.
- .4 The Contractor is responsible to track all horizontal cable runs and outlets in an Excel spreadsheet. Upon completion of the project the spreadsheet is to become part of the project documentation.
- .5 Include in bid all labour, materials, plant, transportation, storage costs, training, tools, equipment, insurance, temporary protection, permits, inspections, bonding, taxes, and all necessary and related items required to provide complete installation and operational systems shown and described.
- .6 Prior to submitting the tender, the Div.27 Contractor shall perform a site survey to become familiar with the site and all conditions of the site affected by the proposed work. No claims for extra payment shall be considered because of failure to fulfil this condition.
- .7 Provide separate price of Maintenance Contract for MACs (move, add, changes) up to 25% of the base install for a period of three years.

1.04 RESPONSIBILITY FOR EXISTING PROPERTY

- .1 Div. 27 Contractor shall assume responsibility for the care, custody and control of existing work completed by others which is assigned to him for performance of the Work.
- .2 Div. 27 Contractor shall assume responsibility for and shall make good, damage to existing work completed by others attributable to performance of Work of this Contract.

1.05 DRAWINGS AND SPECIFICATIONS

- .1 The General Conditions, Supplementary Conditions and Division 01 are part of this specification and shall apply to this Division.
- .2 The Drawings and Specifications shall be held to determine the general character and general arrangement of the Work. The Contract Documents are issued to facilitate construction by expressing the design intent.
- .3 Should any discrepancy appear between the drawings and specifications, the specifications shall be considered the prevailing document. If unsure, a ruling shall be obtained from the Consultant before submitting a Bid. If this is not done, it will be assumed that the more expensive alternative has been allowed for.
- .4 Drawings and Specifications are "design" documents that indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility systems and the architectural elements of construction. As "design" documents, the Drawings and Specifications do not necessarily indicate or describe all Work required for the full performance and completion of the requirements of the Contract Documents. Based on the general scope indicated, described, or implied, the Contractor shall furnish all items required for the proper execution and completion of the Work.
- .5 Symbols used to represent various telecommunications devices often occupy more space on the drawing than the actual device does when installed; in such instances, do not scale

locations of devices from telecommunications symbols. Install these devices with primary regard for usage of wall space, details from architectural drawings, convenience of operation and grouping of devices.

- .6 The Drawings and Specifications do not necessarily contain all the details required to construct the project, and much more detail in the form of detailed construction documents (referred to in the Contract Documents are the Contractors shop drawings, submittals and field coordination drawings) are required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures and site safety precautions are the responsibility of the Contractor and give the Contractor the necessary latitude in carrying out the construction of the Work.
- .7 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate (for those portions of the Work for which submittals are required by the Contract Documents) the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.
- .8 The Contractor shall examine all the drawings and specifications to understand the design intent and the extent of the proposed scope of work within the existing building. By personal examination of the existing building, site and surroundings the Contractor shall make their own estimate of the difficulties attending to the performance and completion of their scope of work.

1.06 SUBMITTALS

- .1 Submit submittals in accordance with Division 01.
- .2 Shop drawings must be submitted for review and acceptance in accordance with Division 01, prior to any products being delivered to the project site.
- .3 Prior to submitting the shop drawings to the Consultant, the Contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.
- .4 The term "shop drawing" means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the work, including a riser diagram.
- .5 Keep a complete set of shop drawings and specifications at job site during construction.

1.07 RECORD DRAWINGS

- .1 The Contractor shall keep on complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications, revisions, and original specification documents for the purpose of record drawings. As the work on site proceeds, the Contractor shall clearly record in Red all as-built conditions which deviate from the original contract documents. Record drawings are to include cable runs (complete with number of cables and ID numbers) and locations of all telecommunications equipment.
- .2 Contractor is to forward letter of certification and as-built records and drawings to the Consultant for final review and acceptance prior to any products being accepted on site. As-built records and drawings are to be submitted in the form of one set of all electronic files on compact disk (CD) and hard copy prints, as necessary.

- .3 As-built Records and Drawings:
 - .1 Provide electronic database reflecting cable installation and cross-connections.
 - .2 Provide electronic drawings in AutoCAD format depicting all construction.
 - .3 Provide two (2) bound complete hard-copy sets of as-built records to the Consultant.
 - .4 Provide and place one (1) additional hard copy of as-built records for each telecommunications room in a plan holder in each telecommunications room. Drawings should reflect the systems and cabling supported from each telecommunications room.
 - .5 The Contractor shall provide information for each copper and fiber cable installed in an excel format to be confirmed by the Owner. Submission of this information must be completed prior to final commissioning of the network infrastructure.

1.08 OPERATION AND MAINTENANCE MANUALS

- .1 At 30 days minimum prior to substantial completion, the Contractor shall submit a draft copy of the proposed contents of each maintenance manual to the Consultant for review. Once the draft copy is approved, the Contractor will supply 4 copies in suitably labeled, hard back, D-ring type commercial binders, each complete with an index and tabbed title sheets for each section.
- .2 All maintenance manual data shall be printed on 8½" x 11" heavy bond, indexed, tabbed, punched and bound in the binders. Each manual shall have a title sheet which is labeled "Operation & Maintenance Manual" and lists the Project name, Contractor's & Consultant's names, date submitted, and a Table of Contents for each volume. If a manual exceeds 75mm in thickness, provide additional manuals as required.
- .3 Each section of the manual shall contain the following information:
 - .1 Systems Descriptions: A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate;
 - .2 Descriptive and technical data;
 - .3 Copy of test data: Must supply a copy to the Consultant and to the Client. All factory tested pre-terminated fiber test results to be included;
 - .4 Include type and accuracy of instruments used to obtain test data. Test device to be calibrated in accordance with manufacturer's requirements;
 - .5 Copy of final inspection certificate;
 - .6 Copy of all warranty certificates;
 - .7 Set of final reviewed shop drawings.

1.09 LABOUR

- .1 The communications Contractor must comply with all job-site requirements for the duration of the project.
- .2 The communications Contractor agrees to use only trade persons who are fully trained, qualified and experienced on the installation, termination and testing of the structured cabling solution. The communications Contractor must be an approved installer of the specific structured cabling solution. All cabling technicians on site must provide proof of individual certification from the manufacture whose products are being installed.

1.10 WARRANTY

- .1 Before substantial completion, submit:
 - .1 All documentation necessary for the cable /component manufacture to initiate registration of the project warranties.

- .2 Show proof of warranty registration to the Owner and include the Project Warranty particulars, claim procedures, contact name and phone numbers in the Project Operation and Maintenance Manuals. Product warranty claims shall not be dependent on original contractor's future existence as a business.
- .3 The warranty on cabling products and installation shall be of 20 years, extended component and application assurance that covers manufacturing and installation defects of cabling components. The material and labour shall be of no cost to owner if warranty issue arises for the period of 20 years.

1.11 SYSTEM DEFECTS FAILURES WARRANTY

- .1 In the event of a *Systemic Failure* to any *Work* or *Goods* supplied by the *Contractor*, within 5 years of the start of the warranty period, the *Contractor* shall replace all units or components of such failed *Work* or *Goods* with another design or *Goods* which can, prior to installation or construction of such *Work* or *Goods*, be shown to be of an equivalent or better quality or condition from the failed *Work* or *Goods*, and the *Warranty Period* for such replacement *Work* or *Goods* shall commence on the completion of the replacement of such units or components of the failed *Work* or *Goods*.
- .2 "*Systemic Failure*" means a total failure of the *Work* or *Goods* procured by the Contractor or a failure of more than a percentage of the units or components comprising the *Work* or number of *Goods* installed or constructed by the *Contractor*, such percentage to be determined by *owner* and the *Corporation* and the *Contractor*, acting reasonably but the percentage shall not exceed 10% of the units or components comprising the *Work* or number of *Goods* to be installed or constructed by the *Contractor*.

2 Products

2.01 SELECTED PRODUCTS & EQUIVALENTS

- .1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The Contractor shall be responsible to remove and replace defective products at their expense, and shall be responsible for any resulting delays and associated expenses which result from defective products being rejected. Related materials shall be of the same manufacturer throughout the project.
- .2 Listed in specifications documents are various examples of material minimum standards of acceptance. These standards of acceptance are to be considered as references stating the minimum acceptable specification to complete the works. The Contractors shall not interpret these minimum standards of acceptance for sole source procurement direction.
- .3 Unless otherwise specifically called for in the specifications, uniformity of manufacture shall be maintained for same products throughout the project.
- .4 Discontinued or end-of-life products will not be acceptable.

2.02 QUALITY OF PRODUCTS

- .1 All products provided shall be CSA approved, Canadian Underwriters Laboratory listed where applicable, and new unless otherwise specified.
- .2 If products specified are not CSA approved, Contractor must obtain special approval from the local regulatory authority, pay all applicable charges levied and make all modifications required for approval.

2.03 USE OF PRODUCTS DURING CONSTRUCTION

- .1 Any equipment used for temporary or construction purposes shall be approved by the Construction Manager and in accordance with the General Conditions, "Use of Premises." Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

3 Execution

3.01 COORDINATION WITH OTHER DIVISIONS

- .1 Examine the specifications and drawings of all Divisions and become fully familiar with their work. Coordinate work with all trades and make changes to facilitate a satisfactory installation.
- .2 Lay out the work and equipment with due regard to architectural, structural, mechanical, electrical and A/V features. Architectural and Structural drawings take precedence over the telecommunications drawings regarding locations of wall, door, equipment and location and outlet heights.
- .3 Coordinate with construction site manager to ensure there are no conflicts.
- .4 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

3.02 LOCATION OF OUTLETS

- .1 Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.
- .2 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

3.03 SEPARATION OF SERVICES

- .1 Maintain separation between electrical wiring system and building piping, ductwork, etc., so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.
- .2 Only communications cables may be installed in communications tray.
- .3 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.
- .4 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Owner and the ceiling installer, and approved clips or hangers are used.

3.04 EQUIPMENT IDENTIFICATION

- .1 Identify information systems equipment with nameplates in accordance with Division 26.
- .2 Nameplates: Lamicoid, 3 mm thick plastic engraving sheet, black face, white core, mechanically attached. Nameplate sizes to correspond to the size of the equipment to be identified. Submit schedule of nameplates, size of each nameplate, and wording and corresponding size of letters for approval prior to installation.

3.05 TESTING

- .1 Perform all necessary tests to confirm the correct operation of all systems.
- .2 Submit letters from manufacturers of all systems indicating that they have checked, tested and verified the respective systems and are satisfied with the methods of installation, connection and operation.
- .3 Inform the Consultant 30 days in advance of the dates when the tests are to be carried out.
- .4 Submit all test results in duplicate hardcopy and soft copy to the Consultant for approval.

3.06 COMMISSIONING

- .1 In addition to testing, provide one technician and necessary test equipment to commission up to 10% of the installed fiber and copper infrastructure in conjunction with the commissioning agent.

3.07 MOUNTING HEIGHTS

- .1 Refer to all Architectural drawings for telecommunications outlet mounting height direction and requirements.

3.08 SEALING OF WALL AND FLOOR OPENINGS

- .1 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating material. Approved fire stopping materials as per are to be used for all fire rated cable penetrations through horizontal and vertical fire separations.

END OF SECTION 27 05 00

1 GENERAL

1.01 SUMMARY

- .1 This Section describes firestopping systems for the passage of low-voltage communications cables through fire-rated shafts, partitions, and barriers.

1.02 RELATED SECTIONS

- .1 Related Work: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere, to produce a complete installation.
- .2 This Specification should be considered as an augmentation to Section 07 84 00 Firestopping.
- .3 This Section address those unique elements that affect the Firestopping of Information Technology cabling systems which may not be addressed in other Sections.

1.03 REFERENCES

- .1 CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.
- .2 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems.
- .3 Underwriters Laboratories Canada, Inc. (ULC), Fire Resistance Directory.
- .4 Underwriters Laboratories, Inc. (cUL), Fire Resistance Directory of Products Certified for use in Canada.

1.04 PERFORMANCE REQUIREMENTS

- .1 Fire-rated cable pathway devices must be used for ALL low-voltage, video, data and voice cabling, optical fibre raceways, and certain high-voltage cabling where frequent cable moves, adds, and changes may occur. Such devices must:
 - .1 Meet the hourly fire rating of fire-rated wall and or floor penetrated.
 - .2 Be tested for the surrounding construction and cable types involved.
 - .3 Have ULC, cUL, or cULus Systems permitting cable loads from; "*Zero to 100% Visual Fill*." This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by ULC, cUL, or cULus System.
 - .4 Not have a constrictive inner liner constricting around or compresses cables tightly together encouraging potential alien crosstalk or network interference.
 - .5 Be "Zero-Maintenance", "Zero-Maintenance" is defined as; no action required by cabling technician to open and/or close pathway for cable moves, adds, or changes, such as, but not limited to:
 - .1 Opening or closing of doors.
 - .2 Spinning rings to open or close fabric liner.
 - .3 Removal and/or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
 - .4 Provide letter from manufacturer certifying compliance with this definition of "Zero-Maintenance".

- .6 Pathways must be engineered such that two or more devices may be ganged together for larger cable capacities.
- .7 Pathways must be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
- .8 Cable Pathway Devices passing vertically through floors must have equal FT Rating. (See cUL System # F-A-3037, Item #4 "EZ-PATH Grid T-Rating Kit" Part # TRK444).
- .9 Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, Authorities Having Jurisdiction, other manufacturer of the device, and the corresponding ULC or cUL System number installed.
- .2 As an alternate to using a fire-rated cable pathway device for single or a pair of low-voltage cables (up to 0.53 in. / 14 mm) penetrating one or two-hour gypsum board/stud wall assemblies, either as a through-penetration or as a membrane-penetration, a fire-rated cable grommet may be substituted. The firestop must consist of a molded, two-piece, plenum-rated grommet having a foam fire and smoke sealing membrane complying with the outside diameter of the individual cable(s). The grommet product must be capable of locking into place to secure the cable penetration within the wall assembly. The grommet must be ULC or cUL Classified and tested to the requirements of CAN/ULC S115. Ready® Firestop Grommet RFG1 or RFG2.
- .3 Where non-mechanical pathways cannot be used, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during or after construction. Provide letter from manufacturer certifying compliance with this Section.
- .4 Cable pathway must replace conduit sleeves in walls and floors, and:
 - .1 When installed individually in floors, devices must pass through core-drilled opening utilizing tested floor plates.
 - .2 When multiple units are ganged in floors, devices must be anchored by means of a tested grid.
 - .3 When installed individually in walls, devices must pass through core drilled opening utilizing tested wall plates.
 - .4 When multiple units are ganged in walls, devices must be anchored by means of a tested grid.
- .5 Cable tray must terminate at each fire barrier and resume on the other side such that cables pass independently through devices. Cable tray must be properly supported on each side of fire barrier.

1.05 SUBMITTALS

- .1 Submit under provisions of Section 01 30 00.
- .2 Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.
- .3 Schedule of ULC, cUL, or cULus System Drawings: Submit schedule of all expected opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings. If engineering recommendations are necessary, list these in the schedule too.
- .4 ULC, cUL, or cULus System Drawings: Provide copies of all ULC, cUL, or cULus Systems identified in schedule above. If engineering judgments are necessary, the submittal must include the project name, the EJ ID #, and the name of the contractor doing the installation.

- .5 Certificates: Product Certificate of Compliance from the firestop system manufacturer certifying material compliance with applicable Code and specified performance characteristics.
- .6 Installation Instructions: Submit manufacturer's printed installation instructions.

1.06 QUALITY ASSURANCE

- .1 Products/Systems: Provide Firestopping systems complying with the following requirements:
 - .1 Proposed firestop materials and methods will conform to applicable governing codes having location jurisdiction;
 - .2 Firestopping tests are performed by a qualified, testing, and inspection agency. A qualified testing and inspection agency is ULC or cUL, or another agency performing testing and follow-up inspection services for firestop system acceptable to Authorities Having Jurisdiction.
 - .3 Firestopping products bear the classification marking of qualified testing and inspection agency.
- .2 Installer Qualifications: Experience in performing work of this Section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.
- .3 Field Inspections: Inspection of completed work must be performed by an Authority Having Jurisdiction (AHJ), and/or the building underwriter's designee. If required by AHJ or underwriter, inspections may be performed by an independent, third-party construction inspection and testing service provided that:
 - .1 Inspections are performed to the requirements of the following Standards, as applicable.
 - .1 Construction Joints: ASTM E2393 - 10a, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
 - .1 Service Penetrations: ASTM E2174 - 10a, Standard Practice for On-Site Inspection of Installed Fire Stops.
 - .2 Individual(s) performing inspection must provide evidence of valid Errors and Omissions Insurance Coverage for this service.
 - .3 Individual(s) performing inspection must not have any financial connection to installer, especially including firestop manufacturer, distributor, or supplier.

1.07 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery:
 - .1 Manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instruction for multi-component products.

1.08 PROJECT CONDITIONS

- .1 Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.
- .2 Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

- .3 Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.
- .4 Do not use materials containing flammable solvents.
- .5 Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- .6 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- .7 Schedule installation of firestopping after completion of penetrating item installation, but prior to covering or concealing of openings.

2 PRODUCTS

2.01 MANUFACTURERS

- .1 Acceptable Manufacturer: Specified Technologies Inc
- .2 EZ-Path® is the basis for design. There is no known equal. Submitter must prove that proposed substitution complies with Section 1.4 Performance Requirements and accept full liability for removal and replacement of specified product, if substituted product fails to meet or exceed specified performance requirements.
- .3 Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.02 MATERIALS

- .1 General: Use only firestopping products that have been tested for specific fire-resistance rated construction conditions complying with construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
- .2 Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
 - .1 Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway:
 - .1 22 Series;
 - .1 33 Series;
 - .2 44 Series.

3 EXECUTION

3.01 EXAMINATION

- .1 Prior to installation, verify substrate conditions previously installed under other Sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.
- .2 Surfaces must be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.
- .3 Provide masking and temporary covering to protect adjacent surfaces.
- .4 Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- .1 General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

3.03 FIELD QUALITY CONTROL

- .1 Inspections: Owner must engage qualified independent inspection agency to inspect through-penetration firestop systems.
- .2 Keep areas of work accessible until inspection by Authorities Having Jurisdiction.
- .3 Where deficiencies are found, repair firestopping products so they comply with requirements.

3.04 ADJUSTING AND CLEANING

- .1 Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- .2 Clean all surfaces adjacent to sealed openings to be free of excess Firestopping materials and soiling as work progresses.

3.05 DOCUMENTATION

- .1 Place system stickers on each side of wall penetrations.
- .2 Place a reproduction (photocopy) of the UL System description in a document protector and mount to the wall next to the wall penetration.
 - .1 Highlight the section of the system description listing the allowed cable types.

END OF SECTION 27 25 00

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
 - .1 Section 26 05 00 – Common Work

1.2 PRODUCT DATA

- .1 The existing security system at the Hospital is an HID system.

1.3 SCOPE

- .1 Division 26 to provide rough ins for all devices shown on the drawings including but not limited to: providing conduit with pull wire, providing 120V power for door controllers, providing junction boxes, providing pathways for low voltage wiring, etc.
- .2 Division 28 is to provide all devices and low voltage control wiring.
- .3 Co-ordinate with owner's access control supplier (HID) and owner's enterprise security team to facilitate system implementation during the construction period.

1.4 SHOP DRAWINGS

- .1 Product Data: Provide complete product data that includes the following:
 - .1 Manufacturer's technical data for all material and equipment at the system and sub system level.

Part 2 Products

- .1 All access control devices to be HID.

Part 3 Execution

3.1 INSTALLATION

- .1 Conduit must be used for security cabling within the secured space. Cable tray and J-hooks may be utilized to run security wiring outside of secured spaces.
- .2 All cable and equipment supplied, and all installation methods used, shall be as specified by the equipment manufacturer.
- .3 No splices shall be permitted in the wiring except where a connection is made to a device.
- .4 All cables shall be permanently identified and listed on as-built drawings as follows:
 - .1 Cable number

- .2 Source
- .3 Destination
- .5 Electrical panel circuit number shall be clearly identified on all system panels and fed from the emergency power system.

3.2 LABELING

- .1 All wire and cable to be labeled with suitable identification code affixed to cable jacket near terminations. Label to be permanently affixed, vinyl, plastic or similar material.

3.3 TESTS AND ADJUSTMENTS

- .1 Upon completion of system installation, the contractor is to provide assistance to the security contractor for system tests. Typical tests are shown below
- .2 Testing Procedures:
 - .1 A door or point has to pass all the tests listed below in order for it to be marked as verified.
 - .1 Typical "check list" shown below is for reference purposes.
 - .1 Security control panel location and mounting height as per Drawings and Specifications.
 - .2 Sufficient working space in front of the security control panel to perform maintenance.
 - .3 Readers or other access devices located where they are accessible.
 - .4 Security sensors are located, aimed and directed to best insure operation efficiencies.
 - .5 Emergency power backup of Security System is in place and functioning.
 - .6 Security System has been tested and verification of the success of the test has been made available.
 - .7 Interfacing between the Access Control System and the following systems has been done:
 - .1 Fire Alarm system
 - .8 Each security panel is tagged and identified.
 - .9 Individual conductors are tagged and identified, and terminals and terminal strips are tagged and identified.
 - .10 Raceways, junction boxes and termination cabinets are identified with color-coded bands or other approved means.

END OF SECTION

Part 1 General

1.1 SCOPE OF RESPONSIBILITY

- .1 The Electrical Contractor shall assume the overall responsibility for provision of a the new cameras added to the existing video surveillance system, and ensure system is operational.
- .2 Provide an independent conduit system for video surveillance system, not to be shared with other systems.

1.2 SUBMITTALS

- .1 Submit equipment shop drawings for Owner's review.

1.3 SUPPORT SERVICES

- .1 Not applicable.

Part 2 Products

2.1 MATERIALS

- .1 IP Cameras:
 - .1 2 megapixel resolution
 - .2 75° field of view
 - .3 Adjustable image size, framerate, quality
 - .4 Timestamped and with text overlay
 - .5 Configurable motion detection window
 - .6 Configurable privacy mask zones
 - .7 1920 x 1080 resolution @ min. 15 fps
 - .8 1280 x 720 resolution @ min. 30 fps
- .2 360° Cameras:
 - .1 360° field of view
- .3 Internal CCTV cameras shall be IP cameras.
- .4 Cabling connecting cameras to the head end shall be CAT6. Whenever recommended by equipment manufacturer, contractor shall supply and install pre-terminated CAT6 STP.

Part 3 Execution

3.1 SYSTEM COORDINATION

- .1 Prior to implementing rough-ins in accordance with the drawings, coordinate exact system requirements with Owner.
- .2 Coordinate exact location of camera equipment prior to rough-in of camera junction boxes. Provide backing for adequate camera support as required.
- .3 Camera licensing will be arranged by the Owner and excluded from this contract.

3.2 INSTALLATION

- .1 Provide EMT conduit from each camera locations to the location of the nearest cable tray. Minimum junction box size at each camera location shall be 4"x4"x2".
- .2 Install cameras in accordance with manufacturer's instructions and recommended practices at locations indicated on the drawings. In case of a conflict between manufacturer's recommendations and Contract Documents, notify the Owner prior to proceeding.

3.3 TESTING

- .1 Coordinate camera field of view requirements and complete all the necessary adjustments prior to equipment turn-over.
- .2 Verify equipment performance during day-time and night-time conditions. Adjust equipment to avoid glare while retaining the field of view specified by the Owner. Advise the Owner if adjustment is insufficient to resolve the issue.

3.4 FIELD QUALITY CONTROL

- .1 Complete system commissioning and training in accordance with Div 01 and Section 26 05 01 – Common Work Results – Electrical.
- .2 Submit written report confirming compliance of Work with Contract Documents as a part of the Operations and Maintenance manual.
- .3 Submit a test report as a part of the Operations and Maintenance manual. Test report shall include a brief description of all tests, test results (pass / fail), name and signature of Consultant, names of Owner's representative(s) in attendance (if applicable), and any notes / observations made during testing.

END OF SECTION

1 General

1.01 SUMMARY

- .1 The existing Fire Alarm System is by CI.
- .2 Retain and pay for the services of the base building Fire Alarm System vendor to perform the work including all firmware hardware and software. Base Building Fire Alarm System vendors includes notifier authorized contractor, to programming changes and updates to the network.
- .3 Updating the Fire Alarm System graphics.
- .4 Provide additional wiring in conduit as required.

1.02 SUBMITTALS

- .1 Submit dimensional drawings of all the fire alarm System components and accessories.
- .2 Update one-line diagram of system configuration.
- .3 Wiring diagram.
- .4 Updated zoning diagram.

2 PRODUCT

- .1 All product supplied shall be compatible with the existing system.
- .2 All products shall be CSA/ULC listed product for the application.

3 EXECUTION

- .1 Installation shall be in accordance with the manufacturer's instruction and relevant codes.
- .2 The manufacturer shall provide a factory authorize technician to confirm proper installation and operation of all systems, components, entire fire alarm for an integrated operation.
- .3 Manufacturer shall provide a factory authorized application engineer to train owner's personnel in the operation of the system.
- .4 Provide a Fire Alarm System verification report.
- .5 Provide an audibility report of the Fire Alarm System.

END OF SECTION 28 31 00