

Part 1 General

1.1 RELATED SECTIONS

- .1 Summary of Work: Division 01.
- .2 Project Meetings: Division 01.
- .3 Regulatory Requirements: Division 01.
- .4 Submittal Procedures: Division 01.
- .5 Quality Control: Division 01.
- .6 Examination and Preparation: Division 01.
- .7 Execution: Division 01.
- .8 Cleaning: Division 01.
- .9 Closeout Procedure: Division 01.
- .10 Commissioning Plan: Division 01.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, 21st Edition
 - .2 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 SCOPE OF WORK

- .1 The Scope of work under this contract comprises of electrical upgrades to the Coutts Border Crossing Facility. The scope of work includes the following:

- .1 Replacement of the existing Automatic Transfer Switch with a unit incorporating isolation bypass switch and closed transition transfer functions. The new ATS will be placed in a new location and will require new wiring.
- .2 Addition of Surge Protection Devices for emergency branch and distribution panelboards.
- .3 Addition of a Power Quality Meter for the Emergency Distribution.
- .4 Load Balancing of the electrical branch and distribution panelboards.
- .5 Scope includes all non-electrical work to complete installation, including but not limited to installation of housekeeping pads/structure, fire rated compartments, fire stopping, drywall cutting, sealing and painting, etc.
- .6 Testing and Commissioning of electrical equipment.

1.4 REGULATORY REQUIRMENTS

- .1 Comply with Safety Codes Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code.
- .2 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the latest edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.
- .3 All electrical products shall be tested, certified and labelled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labelled, provide written approval by the authority having jurisdiction.
- .4 Submit to authority having jurisdiction and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.
- .5 Submit to Owner, copy of electrical permit obtained from authority having jurisdiction.
- .6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.
- .7 The General Conditions, Supplementary Conditions and Section 01 are a part of this specification and shall apply to this Division.
- .8 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.

- .9 Symbols used to represent various electrical 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 electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.
- .10 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.
- .11 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.
- .12 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, advise the Consultant for clarification before submitting tender. Clarification shall be giving in writing prior to the closing of the tender. Tender based on all drawings and specifications not electrical alone. If discrepancies occur the high cost option shall be carried in the contractor's costs for tender purposes.
- .13 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.
- .14 Electrical contractor is to coordinate the exact locations and mounting heights of all equipment with other divisions prior to rough-in. Coordinate with mechanical, security, architectural, and mill work drawings.
- .15 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.

1.5 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.6 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.7 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 000 - Submittals.
- .2 Submit for review single line electrical diagrams under Plexiglas and locate as indicated on the electrical drawings.
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation and distribution systems in power plant rooms.
- .3 Submit for review fire alarm riser diagram, plan and zoning of building under Plexiglas at fire alarm control panel and annunciator.
- .4 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .2 Submit shop drawings of all electrical components as required by the Consultant. Approval of shop drawings is for general design only and does not relieve the electrical contractor and/or their supplier or manufacturer from complying with all requirements of drawings, plans and specifications. The electrical contractor is responsible for conforming to and coordinating all dimensions. The electrical contractor to take note that any shop drawing revisions required after the second review shall be at their own expense.
 - .3 Prior to submission, all shop drawings are to be stamped, dated and signed by the electrical contractor and the general contractor.
 - .4 The electrical contractor is to coordinate each shop drawing submission with requirements of the contract documents. Individual drawings will not be reviewed until all related shop drawings and product data is available.
 - .5 The electrical contractor is to review shop drawings and assume responsibility for:
 - .1 Completeness – including all details specified
 - .2 Dimensions, field measurements
 - .3 Catalogue numbers and similar data
 - .4 Conformance with contract documents
 - .5 Colors.

- .6 Site conditions.
- .7 Interference with mechanical equipment including motor sizes and loads, equipment locations and connection points.
- .6 Shop drawing to include:
 - .1 Name of contractor, subcontractor, supplier and manufacturer.
 - .2 Date and revision dates.
 - .3 Project name.
 - .4 All pertinent data.
 - .5 Specification section number.
 - .6 Electrical contractor's stamp and general contractor's stamp.
 - .7 A clear space of 100mm x 75mm on each sheet for placement of the Consultant's review stamp.
 - .8 Each sheet to be number sequentially.
 - .9 Model and type numbers.
- .7 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
- .8 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .9 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .10 Submit copies of drawings and product data to Consultant.
- .11 If changes are required, notify Consultant of these changes before they are made.
- .12 Comply with requirements of Division 01.
- .13 Submit shop drawings, product data and samples as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials. Include data on manufacturer's recommended environmental conditions for equipment affected by temperature and humidity.
- .14 Provide wiring, single line and schematic diagrams for electrical control systems and where otherwise applicable. Include wiring drawings or diagrams showing interconnection among work of different Sections.
- .15 Cross or block out from manufacturer's standard product data sheets all data inapplicable or irrelevant to project.
- .16 All component identification numbers for communications equipment shall be generic.

- .17 Shop drawings will not be reviewed if they:
 - .1 Are not clearly legible.
 - .2 Do not contain all information required above.
 - .3 Describe other products or models not applicable to this project.
 - .4 Alternates will not be reviewed unless submitted in accordance with the products and substitutions section and are submitted pre-tender for approval.
- .18 Keep one complete set of shop drawings at job site during construction.
- .19 Provide product data for the following:
 - .1 Panelboards & distribution equipment
 - .2 Control panels.
 - .3 Cable Tray and Support System
 - .4 Other electrical items that pertain to this contract.
- .5 Quality Control: in accordance with Section 01 00 01 - General Requirements.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction and the electrical inspection authorities for approval before delivery to site. All associated costs carried by the contractor.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Consultant.
- .6 Manufacturer's Field Reports: submit to Consultant manufacturer's written report, within 5 days of review, verifying compliance of Work and electrical system and instrumentation testing as described in PART 3 - FIELD QUALITY CONTROL.

1.8 OPERATION AND MAINTENANCE MANUALS

- .1 Within 30 days prior to substantial performance, 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 labelled, hard back, D-Ring type commercial binders, each complete with an index and tabbed title sheets for each section. Final copies of manuals to be received by Consultant not less than 7 days prior to substantial performance.

- .2 All maintenance manual data shall be printed on 8 1/2" x 11" heavy bond, indexed, tabbed, punched and bound in the binders. Each manual shall have a title sheet which is labelled "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 75 mm 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 Maintenance and operating instructions for all electrical equipment and controls. (These operating instructions need not be manufacturer's data but may be typewritten instructions in simple language to guide the Owner in the proper operation and maintenance of his installation.)
 - .4 Lubricating and servicing intervals recommended.
 - .5 A copy of all wiring diagrams complete with wire coding.
 - .6 List of spare parts of all electrical equipment complete with names and addresses of sales, service representatives and suppliers.
 - .7 Copy of test data
 - .8 A motor list showing each motor number, name, horsepower, full load amps, overload settings, nameplate, current rating, heater size and type, and current being drawn.
 - .9 Include type and accuracy of instruments used to obtain test data.
 - .10 Copy of final inspection certificate.
 - .11 Copy of the purchase order, showing equipment make and model numbers issued to the manufacturer complete with all addendums.
 - .12 Copy of all warranty certificates. Provide a one year warranty on all equipment, regardless of manufacturer's warranty, and will commence post 45 days of substantial completion certificate date.
 - .13 Set of final reviewed Shop Drawings.
 - .14 Names, addresses, phone numbers and facsimile numbers of Contractor, sub-contractors and suppliers used on the work together with a specification reference of the portion of the work they undertook.
 - .15 Manufacturer's product data, including performance curves and schematic and wiring diagrams for all electrical control systems. Manufacturer's installation instructions. Manufacturer's operation instructions. Manufacturer's maintenance instructions, including complete parts list for all serviceable components.

.16 Digital photos of all underground installations prior to backfill.

1.9 RECORD DRAWINGS

- .1 The Contractor shall keep one complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions which deviate from the original contract documents. Record drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.
- .2 Contractor shall retain the services of an Engineering Company to transfer all as-built information from the contractor site drawings to the appropriate cad files can client format. Carry **\$4000 for the Engineering Consultant** to perform the service. The Engineering Consultant will provide the Owner one hard copy and one electronic copy of the record drawings showing all as-built information as shown by the electrical contractor.

1.10 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 00 01 - General Requirements.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license and apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
 - .1 In accordance with Section 01 00 01 - General Requirements.
 - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Three times during progress of Work at 25%, 50%, and 80% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 00 01 - General Requirements.
- .5 Codes, Rules, Permits & Fees
 - .1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.
 - .2 Quality of work specified and/or shown on the drawings shall not be reduced by the foregoing requirements.
 - .3 Immediately after award of contract and prior to installation, verify location, arrangement and point of attachment for service and service entrance equipment with supply authority and inspection departments. Failure to do so will render this Division responsible for any corrections necessary without additional compensation.
 - .4 Give all required notices, submit drawings, obtain all permits, licenses and certificates and pay all fees required for this work.
 - .5 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Consultant.
- .6 Standards of Workmanship
 - .1 Execute all work in a competent manner and to present an acceptable appearance when completed.
 - .2 Employ a competent supervisor and a sufficient number of licensed tradesmen to complete the Work in the required time.
 - .3 Arrange and install products to fit properly into designated building spaces.
 - .4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide General Contractor with a schedule within 2 weeks after award of Contract.

1.12 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

- .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- .3 Safety precautions.
- .4 Procedures to be followed in event of equipment failure.
- .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.13 PRODUCT OPTIONS AND SUBSTITUTIONS

- .1 All product substitutions must be pre-tender approved by the Consultant. Failure to obtain pre-tender approval from the Consultant will result in the alternative product being rejected, in the event that the current model number is no longer available the Contractor shall provide an approved equal product at no additional cost to the owner.
- .2 The Contractor shall assume full responsibility for ensuring that when providing alternative products or materials, all space, weight, connections, power and wiring requirements etc. are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts and plans, etc. that may be necessary will be borne by the contractor.
- .3 Contractor to submit all requests for alternative product approval to the Consultant. Submissions must be received by the Consultant not less than **seven (7) working days** prior to the close of tenders. Submissions received after the “Cut-Off” date will not be reviewed or accepted.
- .4 All submissions which are approved by the Consultant shall be identified as “Approved Alternatives”. Date stamps prior to tender close.
- .5 Approval of an alternate is not intended to change the original specifications unless specifically stated in the addenda. The submitter is responsible for all costs incurred by other trades as well as his own, to install the product/system in accordance with the contract documents.

- .6 The Consultant is not obliged to accept any or all Alternative Products and/or Proposed Substitutions offered by the Contractor. The Consultant reserves the right to dismiss any or all items with no further explanation.
- .7 All submissions to be provided with technical data and whatever pertinent information that may be required by the Consultant to evaluate equivalency to the specified product. The responsibility to provide sufficient technical data with respect to submissions will remain solely with those making the submission.
- .8 Contractor shall prepare a list of Proposed Substitutions and submit for review by the Consultant within seven (7) working days after notification of award of contract. The completed list must include statements of respective costs of items originally specified and proposed substitutions.
- .9 Substitute Products: Where substitute products are permitted, prior to tender close, unnamed products will be accepted by the Consultant, subject to the following:
 - .1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.
- .10 Substitute Manufacturers: Where substitute manufacturers are permitted, prior to tender close, unnamed manufacturers will be accepted by the Consultant, subject to the following:
 - .1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.
- .11 In making a substitution Contractor represents that:
 - .1 He has investigated substitute product or manufacturer, or both, and has determined that it meets the criteria specified in 4.1 or 4.2, or both, and
 - .2 He will make any changes to the Work necessitated by the substitution as required for the Work to be complete in all respects, and
 - .3 He waives claims for additional costs and time caused by substitution which may subsequently become apparent.
- .12 Substitutions shall not be ordered nor installed without the Consultant's written acceptance. Where substitutions are found in the Work that have not been formally accepted by the Consultant, the Contractor will be required to remove such products and replace with specified materials or provide a credit to the value of the contract at the Consultant's discretion.

- .13 If in the Consultant's opinion, a substitution does not meet requirements of Contract Documents, Contractor shall, at no extra cost to the owner, provide a product which, in the Consultant's opinion, does meet requirements of Contract Documents.

1.14 SYSTEM STARTUP

- .1 Instruct Owners Representative, Consultant and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.
- .4 Inform owner prior to preliminary start-up if representative wants to be present.

1.15 GUARANTEE

- .1 Furnish a written guarantee to the Owner prior to final contract payment, which will be in effect for one year post 45 days from the date of final acceptance of the complete work. Replace or repair at no cost to the Owner any defective material or workmanship except where, in the opinion of the Consultant, such defects are due to the misuse or neglect by the Owner.
- .2 This general guarantee shall not act as a waiver of any specified or special equipment guarantees which cover a greater length of time, but will warranty equipment which is not covered up to minimum 1 year by the manufacturer's warranty to include equipment parts, labour and all associated travel expenses to and from the site. All off hours work to accommodate owner's schedule.

Part 2 Products

2.1 PRODUCTS, MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 00 01 - General Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having

jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

- .3 Factory assemble control panels and component assemblies.
- .4 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.
- .5 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Bid.
- .6 The design has been based on the use of the specified products.
- .7 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.
- .8 Finish all cabinets, panelboards, switchboards, equipment cabinets, cable trays, etc. in ANSI 61 grey enamel unless otherwise specified.
- .9 Apply primer on all items which are to be finished on the job.
- .10 Touch up all damaged painted finishes with matching lacquer, or, if required by the Consultant, completely repaint damaged surface.
- .11 All boxes suited as per NEMA ratings where required to suit location installed in. For example, exterior weatherproof, hazardous locations, explosions proof, etc.

2.2 USE OF PRODUCTS DURING CONSTRUCTION

- .1 Any equipment used for temporary or construction purposes shall be approved by the Owner and the Consultant and in accordance with the use of premises general conditions. Clean and restore to "as new" condition all equipment prior to the time of substantial completion.
- .2 The warranty period shall not begin until post 45 days from the date of substantial performance of the work.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: plastic laminate for devices and lamicoïd labels for equipment, matt white finish face, black lettering accurately aligned. Lamicoïd labels mechanically attached with rivets or self tapping screws. Red with white inlay for emergency and fire alarm devices.
 - .2 Sizes as follows:

| NAMEPLATE SIZES | | | |
|-----------------|-------------|---------|--------------------|
| Size 1 | 10 x 50 mm | 1 line | 3 mm high letters |
| Size 2 | 12 x 70 mm | 1 line | 5 mm high letters |
| Size 3 | 12 x 70 mm | 2 lines | 3 mm high letters |
| Size 4 | 20 x 90 mm | 1 line | 8 mm high letters |
| Size 5 | 20 x 90 mm | 2 lines | 5 mm high letters |
| Size 6 | 25 x 100 mm | 1 line | 12 mm high letters |
| Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters |
- .2 Wording on nameplates and labels to be approved by Owner and Consultant prior to manufacture.
- .3 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .6 Terminal cabinets and pull boxes: indicate system and voltage.
- .7 Transformers: indicate capacity, primary and secondary voltages.

- .8 3 mm thick plastic lamicoïd name plates, black face, white core, mechanically attached with self tapping screws, 6 mm high lettering, to be attached to the front face of the following equipment:
 - .1 Panelboard, splitters, fused disconnects (Designation, voltage, Bus Capacity)
 - .2 Terminal cabinets and pull boxes (system, voltage)
 - .3 Data/Security Misc Racks
 - .4 Motor Starters/VFD's
 - .5 Low voltage Lighting Cabinets

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered plastic tapes on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Color code exposed conduits and conduits above T-bar ceilings, junction and pull boxes, and metallic sheathed cables with paint or plastic tape (25 mm wide band) at 15 metre intervals. Color coding to be as per the Owners standard or as follows (if discrepancy exists the Owners standard will be taken as correct):
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

| | Prime | Auxiliary |
|-----------------------------|--------|-----------|
| up to 250 V | Yellow | |
| up to 600 V | Yellow | Green |
| up to 5 kV | Yellow | Blue |
| up to 15 kV | Yellow | Red |
| Telephone | Green | |
| Other Communication Systems | Green | Blue |
| Fire Alarm | Red | |
| Emergency Voice | Red | Blue |
| Other Security Systems | Red | Yellow |

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish unless noted otherwise.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.
 - .3 Field painting is not acceptable.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 SITE EXAMINATION

- .1 Examine the site of work and become familiar with all features and characteristics affecting this work before submitting tender.
- .2 No additional compensation will be given for extra work due to existing conditions which such examination should have disclosed.
- .3 Report to the Consultant any unsatisfactory conditions which may adversely affect the proper completion of this work 7 days prior to the closing of the tender. Obtain clarification from the Consultant in writing prior to submitting the tender.

3.3 COORDINATION

- .1 Coordinate work specified in the Electrical Specification with work specified in other Sections. Ensure that proper arrangements and provisions are made for work specified in other divisions
- .2 Examine the drawings and specifications of all divisions and become fully familiar with their work. Before commencing work, obtain a ruling from the Consultant if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.

- .3 Lay out the work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding locations of walls, doors and equipment.
- .4 Electrical Contractor shall coordinate with Mechanical contractor, refrigeration contractor and owner supplied equipment supplier all work prior to rough-in.
- .5 Electrical Contractor shall coordinate with the security drawings and security contractor prior to rough-in. Electrical contractor shall supply and install all security back boxes, conduit and pull string. Refer to Security drawings for device layouts.
- .6 Electrical Contractor shall coordinate with the owners Information Technology department for the work to be performed in the IT room and all other areas that have owner supplied equipment to be installed and connected by the electrical contractor.
- .7 Do not cut or core structural members without written approval of the Structural Engineer. Include for all associated xray costs as required for sawcut and coring.
- .8 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.
- .9 Examine previously constructed work and notify the Consultant of any conditions which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

3.4 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.5 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: rigid schedule PVC pipe sized for free passage of conduit, and protruding 50 mm from concrete.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

- .4 Provide plenum rated cabling for all cables which are run free air or in open cable tray in plenum rated ceiling.

3.6 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised up to 3 meters to suit construction and equipment arrangements without additional cost to the Owner, provided that the Contractor is notified prior to the installation of the outlets, or equipment.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.
- .5 Electrical drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.
- .6 Maintain luminaire locations wherever possible. Notify the Consultant of conflicts with other services. All recessed luminaires installed in insulated ceiling spaces to receive IC rated cans regardless of fixture schedule rough-in model number.
- .7 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.
- .8 All panels or boxes installed in fire rated walls which breach fire separations will receive drywall fire rated enclosures.

3.7 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. Cable trays passing through fire separations shall be fire sealed or conduit adaptors utilized throughout separate areas.

- .2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.
- .3 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 Consultant and the ceiling installer, and approved clips or hangers are used.

3.8 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise. Verify all heights with architectural ceiling dimensions.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 150 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: 2000 mm top of cover.
 - .4 Telephone, and Data outlets: 300 mm.
 - .5 Wall mounted telephone outlets: 1500 mm.
 - .6 Fire alarm stations: 1500 mm.
 - .7 Fire alarm bells: 2100 mm.
 - .8 Above perimeter wall baseboard heaters.

3.9 WIRING TO EQUIPMENT SUPPLIED BY OTHERS

- .1 Equipment supplied by the Owner or under other Division will be moved to the site by others. However, the electrical connection to the equipment shall be done by the electrical contractor. This will include all specialty male and female cord ends and flex cable or SI style cords. Direct wired equipment to receive local disconnect at unit.

3.10 FIELD QUALITY CONTROL

- .1 Load Balance:

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 00 01 - General Requirements.
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system and communications.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
 - .3 Carry out tests in presence of Consultant.
 - .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
 - .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.11 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 Do the following prior to Interim Acceptance of the Work, as required to remove all construction dust and debris:
 - .1 Clean out all cabinets and enclosures with vacuum or compressed air.
 - .2 Wipe all insulators with clean, dry rags.
 - .3 Clean all light fixtures and lenses.

3.12 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Overcurrent coordination curves to be set by the manufacturer of the distribution equipment. Electrical contractor to complete the overcurrent settings according to the coordination values supplied by the distribution manufacturer.

3.13 SINGLE LINE DIAGRAM

- .1 Provide and mount a framed as-built single line diagram of the complete power distribution system to be located adjacent to the main distribution board. Use a clear plexiglass cover or laminate.

3.14 HOUSEKEEPING PADS

- .1 All floor mounted electrical equipment installed by this Division shall be mounted on concrete housekeeping pads which, unless otherwise noted, shall be the responsibility of the Electrical Contractor.
- .2 The Electrical Contractor shall determine the extent of the housekeeping pads required and supply all information and details as to size and locations to the Consultant within thirty days after the award of the Contract.

3.15 SLEEVES

- .1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc.

- .2 For wall, partitions and ceilings the ends shall be flush with the finish on both sides but for floors they shall extend 4" above finished floor level.
- .3 The space between the sleeve and the conduit shall be filled with Dow Corning silicone RTV foam for fire stop and caulked around the top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound and ensure that the seal is compatible with the floor and ceiling finishes.
- .4 Locate and position sleeves exactly prior to construction of walls, floors.
- .5 Failure to comply with the above requirements shall be remedied at this Division's expense.

3.16 SEALING OF WALL AND FLOOR OPENINGS

- .1 All conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.
- .2 Openings shall be sealed when all wiring entries have been completed.
- .3 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations to be sealed.

3.17 FIRE STOPPING

- .1 It is the responsibility of the electrical contractor to fire stop all conduit penetrations thru walls, ceilings, and floors. Use CSA approved products.
- .2 Ensure that all penetrations thru exterior walls and roof are sealed and water tight.
- .3 Provide fire rated drywall enclosure for all devices recessed in fire rated walls or ceilings. All costs for enclosures factory or field built by this contractor for his work.

3.18 TESTING

- .1 Refer to following testing sections:
 - .1 Section 260810 - Electrical Starting and Testing General Requirements
 - .2 Section 260820 - Electrical Starting and Testing by Contractor

- .3 Section 260830 - Electrical Starting and Testing by Contractors' Testing Agent.
- .2 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, authority having jurisdiction and the Contract Documents.
- .3 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.
- .4 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .5 Submit, at completion of work, report listing 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.
- .6 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, authority having jurisdiction and the Contract Documents.
- .7 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.
- .8 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .9 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State the hour and date on which each load was measured, and voltage at time of test.

END OF SECTION