Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section covers items common to all sections of Division 26, and 28.

.2 Coordinate location and installation of all equipment with all trades to ensure the equipment with all trades to ensure the equipment is serviceable.

.3 The word “provide” shall mean “supply, install, test and comission”.

1.2 REFERENCES

.1 Provide complete installation in accordance with the latest edition of the Ontario Electrical Safety Code and Electrical Bulletins.

.2 Comply with the following additional codes as a minimum:

.1 CSA Standards.

.2 ULC Standards.

.3 Ontario Building Code – Latest Edition.

.4 National Building Code.

.5 Fire Code.

.6 NFPA.

1.3 DEFINITIONS

.1 Inspection authorities shall mean Electrical Safety Authority.

.2 Supply authority shall mean Hydro Ottawa.

.3 Provide shall mean supply, install, test and commission.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages to: CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.4 Language operating requirements: provide identification nameplates and labels for control items in English and French.

.5 Use one nameplate or label for each language.

1.5 CARE, OPERATION AND START-UP

.1 Instruct Departmental Representative and operating personnel in the 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.

.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 with all aspects of its care and operation.

1.6 TIME AND COMPLETION

.1 Commence work upon notification of acceptance of offer, or as outlined in the approved construction schedule.

.2 Verify equipment delivery times immediately and notify Departmental Representative within two (2) weeks of contract award of any deliveries which would affect schedule.

1.7 FIRE AND SAFETY REQUIREMENTS

.1 Comply with National Building Code (Part 8, Health and Safety Measures at Construction and Demolition Sites) and Provincial Regulations for Construction Projects.

1.8 EXISTING SERVICES

.1 Existing services required for work may be used by the Contractor with the Departmental Representative's written consent. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.

.2 Notify the Departmental Representative a minimum of 72 hours in advance of intended interruption of services; obtain requisite permissions.

.3 Keep duration of these interruptions to a minimum. Carry out all interruptions during silent hours or as approved by the Departmental Representative in writing.

.4 Any unscheduled disruption to services to be immediately reinstated.

.5 Existing fire alarm and security systems are to remain fully functional, throughout, provide conduit and wire as required to maintain services during construction.

1.9 DEMOLITION

.1 Disconnect and make safe all systems to be demolished by other Divisions. Refer to other Divisions for extent.

.2 Maintain existing remaining circuits, systems, etc., which pass through construction/demolition areas. Provide additional wire and conduit as required to maintain systems. Additional wire and conduit to be concealed when construction is completed.

.3 Reinstate immediately, any existing remaining systems, inadvertently interrupted during construction or demolition.

.4 Remove all redundant wiring and conduit in ceiling spaces, (i.e. power.).

1.10 PROTECTION

.1 Protect access areas through existing building (lobby, elevator, corridor stairwell, etc.) from damage. Clean area daily or more frequently if directed by Departmental Representative.

.2 Protect exterior areas (roof, walls, etc.) against damage during handling of new and removed materials.

.3 Repair and make good all damaged equipment, etc. to satisfaction of the Departmental Representative.

.4 Protect stored materials; work in process and finished work against damage until take-over.

.5 Protect adjacent areas against spread of dust and dirt beyond work areas.

.6 Protect operatives and other users of site from all hazards.

1.11 CUTTING, PATCHING AND MAKING GOOD

.1 Provide cutting and patching of existing surfaces as required to accommodate new work.

.2 Remove all items so shown or specified.

.3 Patch, mud, sand, paint and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval.

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

.5 Scan slabs before coring or drilling deeper than 25 mm. Provide all required notification, clearance and protection for scanning process. Adjust coring and drilling locations as necessary to avoid rebar and conduits.

.6 Contractor shall provide colour schedule to Departmental Representative, prior to painting.

1.12 CO-ORDINATION

.1 Coordinate the work with all other Divisions, especially Divisions 21, 23 and 25, to ensure systems compatibility, and to ensure schedules and requirements are maintained.

.2 Where perceived interferences occur, prepare detailed sketches indicating proposed solution for review and acceptance by Departmental Representative.

.3 The contract documents are intended to describe complete fully functional systems although not all components are indicated. Division 26 shall provide all required conduits, wiring, equipment, etc. to provide fully functional systems which meet the design intent.

1.13 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Departmental Representative and include in manuals.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 – Common Product Requirements.

.2 Equipment and material to be new CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Factory-assemble control panels and component assemblies.

2.2 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.

Nameplate Sizes			
Size 1	10 x 50 mm	1 line	3mm 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 Labels: electronically printed, self-adhesive plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels:

.1 To indicate volts, phase, amps, HP, etc.

.2 To be submitted to Departmental Representative prior to manufacture for approval.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters, contactors and variable frequency drives: indicate equipment being controlled and voltage, Size 3.

.7 Terminal cabinets and pull boxes: indicate system and voltage, Size 3.

.8 All circuit protective devices to be c/w a lamicoid label mounted inside door of device listing all fuse type and ratings, circuit breaker settings and minimum interrupting ratings.

2.3 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

2.4 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape at points where conduit or cable enters wall, ceiling, or floor, and at 6 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
120/208 V	Blue	
120/240 V	Grey	
277/480 V	Black	
347/600 V	Purple	
Grounding	Brown	
Building controls	Orange	
P.A. Fire Safety	Pink	
Fire alarm	Red	

2.5 TRADE QUALIFICATIONS

.1 The work shall be carried out by licensed electricians with minimum five years experience who hold Ontario Certificates of Qualifications, and current Contractor’s license.

.2 Installation methods and materials to be of strictest quality, and conform to Canadian General Standards Board, Canadian Standards Association, Ontario Building Code and all Local and Provincial Codes and Standards. Discrepancy in Codes to mean strictest rule applies.

.3 The ratio of Journeymen to Apprentices shall not exceed the ratio in the Trade Qualifications and Apprenticeship Act of Ontario.

2.6 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 to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.7 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.8 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

2.9 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

Part 3 Execution

3.1 MOUNTING HEIGHTS

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

.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: 1200 mm.

.4 Panelboards, disconnects, splitters: as required by Code or as indicated.

3.2 CONDUIT AND CABLE INSTALLATION

.1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 Provide all required accessories, inserts, hangers, toggle bolts, support channels, anchors etc. as required to complete systems.

3.3 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to values and settings, as per approved coordination study.

3.4 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads operating. Do tests after space is fully occupied and operational. 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, after space is fully occupied and operational.

.3 Submit, at completion of work, report listing phase and neutral currents on panel boards, 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 Protective Device Coordination Study

.1 Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.

.2 A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-color for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. System coordination, recommended ratings, and setting of protective devices shall be accomplished by a registered professional electrical engineer licensed in the province of Ontario with a minimum of eight years of current experience in the coordination of electrical power systems.

.3 The following information shall be provided on all curve sheets.

.1 Device identification and associated settings/size.

.2 Voltage at which curves are plotted.

.3 Current multiplier.

.4 ANSI frequent fault damage curve.

.5 Cable insulation damage curves.

.6 Transformer inrush point.

.7 Single-line for the portion of the system.

.8 Motor starting profiles (where applicable).

.3 Conduct and pay for following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

.1 Check resistance to ground before energizing.

.2 Carry out tests in presence of Departmental Representative.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Submit test results for Departmental Representative's review.

.5 Hot spot testing:

.1 After 24 hours of operation under full load, perform infrared tests on all cable terminations and connections and all transformer, panel and breaker connections, to ensure the integrity of the system.

.2 Tests to be carried out by using an infrared camera.

.3 Terminations and/or connections failing tests shall be replaced immediately as part of the contract.

.6 Perform tests prior to energizing electrical or mechanical systems.

3.5 FIRE AND SMOKE STOPPING

.1 Provide fire and smoke stopping where conduits, cables, trays, etc., penetrate floor slabs or fire rated walls with an approved ULC listed putty.

.2 In accordance with Section 07 84 00 – Fire Stopping.

3.6 SPRINKLER-PROOF EQUIPMENT

.1 Provide sprinkler-proof equipment in all areas to the local authorities' requirements.

END