

PART 1 - GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 25, 26. This section supplements requirements of Division 01.

1.2 RELATED WORK

- .1 Concrete Encased Duct Banks: Section 33 65 73

1.3 REFERENCES

- .1 CSA-C22.1-15, Canadian Electrical Code, Part 1.
- .2 CAN/CSA C22.2 No. 0.1-M1985 (R2013), General Requirements for Double-Insulated Equipment.
- .3 CAN/CSA-C22.3 No. 1-15, Overhead Systems.
- .4 CSA-C22.3 No. 7-15, Underground Systems.
- .5 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50 000 V.
- .6 EEMAC Y1-2-1979, Standard for Performance Specification for Finishing Systems for Outdoor Electrical Equipment.
- .7 EEMAC 2Y-1-1958, Standard for CEMA Light Gray Colour for Indoor Switchgear.

1.4 SCOPE OF WORK

- .1 General:
 - .1 The work of this contract consists of furnishing all materials, tools, equipment and labour, and performing the electrical services as indicated and as specified herein and on the Architectural, Mechanical and Electrical Drawings.
 - .2 Provide all required conduit support system, conduit and required mounting hardware.
 - .3 Provide and install a diesel generator and power distribution and general services wiring and cables.

- .4 Provide and install exterior electric load bank.
- .5 Demolition and removal of existing diesel generator and all associated components including fuel storage, piping systems, cabling and conduits. Coordinate this work with other disciplines.
- .6 Provide all grounding necessary to satisfy the CEC - Part 1 and the local provincial inspection authority.
- .7 Install and interwire process and mechanical equipment systems including systems specified under other divisions, including provision of all power, control cabling and required conduit and mounting hardware, in accordance with these specifications and shop drawings/requirements.
- .8 Document, test and calibrate to satisfaction of the Departmental Representative, electrical equipment as specified herein and on the drawings.
- .9 Safely store on site all electrical equipment awaiting installation.
- .10 Protect during construction all installed electrical equipment.
- .11 Procure, erect, safely maintain and remove all scaffolding necessary to complete the works.
- .12 Repair/replace equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, at no additional expense to the Contract. These expenses include all material, labour and other fees.
- .13 Obtain any "scope of work" clarification prior to issuing their Tender. Any cost extras due to any misunderstanding/misinterpretation of the scope of work will not be entertained during the construction phase of the work.
- .14 Coordinate/schedule with other trades so that construction proceeds in a timely and efficient manner. Minimize disturbance to existing systems and provide access for plant operator for routine maintenance and inspection.
- .15 Provide DDC hardware and software to integrate deletions and additions.
- .16 Supply and install CSA approved wall mounted control station for generator and load bank control.
- .17 Supply and install Veeder Root instruments on new generator fuel tank and wire to new Veeder Root remote termination unit. Wire new remote termination unit to existing Veeder Root control panel in maintenance office located on the ground floor.
- .18 This project will see the removal of existing building cladding and installation of new. This contractor will be required to remove electrical components from the existing cladding system and reinstate them on the new cladding system. Such systems will include; building lighting, photo controls for lighting, camera systems, security card access systems, intercom systems, fire alarm devices and general purpose power receptacles. The cameras will need to be aimed and focus to complete the installation.

- .19 Installation of electrical services in the old generator room including surface raceway, power for extraction arm, telephone conduit and receptacles.
- .20 Removal and installation of lighting in the existing generator room.
- .21 Supply and installation of canopy lighting.
- .22 Concrete core drilling for installation of conduits.
- .23 Installation of new fire alarm smoke detector and associated programming.
- .24 Complete shutdown work during premium time.

1.5 CODES AND STANDARDS

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead systems in accordance with CAN/CSA-C22.3 No. 1 and underground systems in accordance with CSA C22.3 No. 7, except where specified otherwise.
- .3 Comply with all CSA electrical bulletins in force at the time of tender submission. While not identified or specified by reference number in this division, the bulletins shall be considered to form part of the related CSA part II standard.
- .4 Engage the services of a certified petroleum storage tank installer, recognized by Nova Scotia Environment, to clean and remove diesel storage tanks and product transfer systems.

1.6 CARE, OPERATION AND START-UP

- .1 Instruct operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components, including but not limited to: overload relays, motor circuit protectors, circuit breakers, variable frequency drives, automatic transfer switch and diesel genset.
- .3 Except where noted otherwise, 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.

1.7 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.8 PERMITS, FEES AND INSPECTION

- .1 Submit to the Electrical Inspection Department, Municipal Authority and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Submit this information within ten (10) working days of the award of Tender and provide the Departmental Representative with written notice at the time this has been submitted.
- .2 Provide the Departmental Representative with a copy of the Electrical Inspection Department and Supply Authority Plans Review Report immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.
- .3 Obtain all necessary permits including an Electrical Wiring Permit for electrical work and Communications Cabling Permit for communications cabling work from the authority having jurisdiction prior to commencement of work. Provide a copy of each permit to the Departmental Representative upon receipt. Display the permits on the work site.
- .4 Upon specific request, the Departmental Representative will provide to the Contractor, up to a maximum of three (3) copies of the drawings and specifications required for submittal to the Electrical Inspection Department and Supply Authority. These drawings and specifications will be provided to the Contractor at no cost, unless specified otherwise.
- .5 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Departmental Representative immediately upon receipt. Notify the Departmental Representative immediately of changes required by the authority having jurisdiction prior to making changes. All changes must be approved by the Departmental Representative.
- .6 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of Work. Include a copy in the Operations and Maintenance Manual.
- .7 Pay all associated fees.

- .8 There will be a need to shut down the high voltage service to the building. Coordinate this work with the utility and pay all associated costs at no additional expense to the Contract. Shut down of the high voltage service may be required more than once to work within the operating schedule of the building.

1.9 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00.
- .2 Equipment and material to be CSA certified or certified by an agency recognized by the Electrical Inspection Department. Where there is no alternative to supplying equipment which is not certified, obtain special approval from Electrical Inspection Department and the Departmental Representative.
- .3 Factory assemble control panels and component assemblies.

1.10 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Coordinate location of mechanical and process equipment and associated control devices supplied by other divisions. All device locations may not be necessarily shown on electrical drawings.

1.11 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 indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
 - .2 Paint outdoor electrical equipment green finish to EEMAC Y1-2.
- .2 Clean and touch up surfaces of existing and new shop-painted equipment scratched or marred during shipment or installation, to match original paint to the satisfaction of the Departmental Representative, otherwise replace at no additional cost to the Contract.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.12 FASTENERS AND EQUIPMENT MOUNTING

- .1 Fastening devices for all equipment and components, including bolts, nuts, washers, and screws shall be stainless steel or galvanized steel throughout.
- .2 Mount all wall mounted equipment (disconnect switches, junction boxes, instrumentation, transmitter/ analyzer, etc.) on 19 mm plywood backboard. Paint plywood with two (2) coats of fire retardant enamel paint as specified in Section 09 91 00 - Painting, and secure to 41 mm u-shaped strut fastened to concrete block wall with expansion anchors or toggle bolts.

1.13 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels.
- .2 Identification:
 - .1 Provide all switchboards, panels, disconnect switches, MCC's, receptacles, transformers, control panels, magnetic starters, TOL's, etc. with "lamicoid" nameplates as further described herein. Take care to affix all plates true and level, and plumb in all instances.
 - .2 Affix nameplates to all "metal" surfaces with steel type "pop-rivets".
 - .3 Affix nameplates to other types of surfaces with contact type cement.
 - .4 Affix nameplates to building "exterior" surfaces with nylon inserts and self-tapping screws unless specifically indicated otherwise.
 - .5 Apply contact type cement to complete rear side of plate, as opposed to several locations or areas on same.
 - .6 Lamicoid nameplates installed on distribution panelboards, motor control centres, transformers, etc. to indicate the following:
 - .1 Designated name of equipment.
 - .2 Amperage of overcurrent protection device.
 - .3 Voltages, number of phases and wires.
 - .4 Designation of power source.

PANEL C - 100 AMPS
120/208V - 3PH - 4W
FED FROM PANEL B

- .7 Lamicoid nameplates installed on combination starters, magnetic starters, manual starter and all various systems controls, control panels, disconnect switches, etc., to contain the following information:
- .1 Designated name of equipment or equipment being fed, whichever is applicable.
 - .2 Designated name of power source.
 - .3 Branch circuit breaker number(s) where possible.
 - .4 Voltage(s) and phase.
- | | |
|-------------------|------------------|
| FAN NO. 5 | SUPPLY FAN NO. 3 |
| PANEL H - CKT. 17 | M.C.C. NO. 1 |
| 120V - 1 PH | 600V - 3 PH |
- .8 Install lamicoid nameplates on all junction and/or pull boxes sized 150 mm x 150 mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.
- .9 Install lamicoid nameplates adjacent to each overcurrent device located in switchboards, CDP panels, etc. They need only indicate designated name and/or number of equipment they feed. Unused O.C. devices are to be identified as spare(s).
- .10 Install lamicoid nameplates above all types of receptacles and abutted directly to tops of their respective device plates. Identification is to indicate respective panel source complete with associated circuit breaker number(s). 1.5 mm thick x 13 mm high complete with 6 mm black letters on white core, directly above all flush receptacles. Plate to be identical width as finish device plate.
- .11 Allow for an "average" of 40 letters for each lamicoid nameplate.
- .1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, for all electrical systems except fire alarm systems which shall have red face with white core.
 - .2 1.5 mm thick nameplates above receptacles as previously indicated, with top left and right corners to be rounded off.
 - .3 Lettering on lamicoid nameplates must not "start", nor "end" nearer than 9 mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates to be as indicated in the following chart:

NAMEPLATE SIZES

Size 1	10mm x 50mm	1 line	5mm high letters
Size 2	13mm x 75mm	1 line	6mm high letters
Size 3	19mm x 75mm	2 lines	5mm high letters
Size 4	19mm x 90mm	1 line	10mm high letters
Size 5	50mm x 90mm	2 lines	19mm high letters
Size 6	25mm x 100mm	1 line	19mm high letters
Size 7	25mm x 100mm	2 lines	6mm high letters
Size 8	50mm x 150mm	2 lines	19mm high letters
Size 9	50mm x 90mm	3 lines	10mm high letters

- .3 Have wording on nameplates and labels approved by the Departmental Representative prior to manufacture.
- .4 Identification to be English.
- .5 Co-ordinate names of equipment and systems with other trades to ensure that equipment identification is consistent.
- .6 In addition to required nameplates and colour coding, junction boxes to have the panel and circuit numbers of all wiring contained within listed on the coverplate. List to be written using black indelible marker.
- .7 Identification of electrical junction boxes and pull boxes:
 - .1 Apply colour coding prior to pulling conductors into boxes.
 - .2 Where primary colour only is indicated:
 - .1 Colour inside of box.
 - .2 Colour all cover plates.
 - .3 Where primary and secondary colours are indicated:
 - .1 Paint inside of box with the primary colour.
 - .2 Diagonally apply to each half of the cover plate the primary and secondary colours.
- .8 Provide clearly visible marking on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.
- .9 Provide terminal boxes, panels and miscellaneous equipment fed from two or more sources with a warning nameplate prominently displayed: "CAUTION - MORE THAN ONE SOURCE VOLTAGE".
- .10 Provide terminal boxes, panels and miscellaneous wire ways containing intrinsically safe circuits with a warning, nameplate prominently displayed: "INTRINSICALLY SAFE CIRCUIT".

1.14 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.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Indicate panel and conduit number on all phase conductors (i.e., Panel A, ckt 3) at the device and at any intermediate junction/pull boxes.

- .6 Identify all neutral conductors to indicate the phase conductor with which they are associated and at any intermediate junction/pull boxes.
- .7 Indicate MCC designation and section number or field mounted motor starter on all phase conductors at the device.

1.15 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 19 mm wide auxiliary colour.

	<u>Prime</u>	<u>Auxiliary</u>
up to 250 V	yellow	
up to 600 V	yellow	green
Telephone	blue	grey
Fire alarm	red	
Other Communication		
Systems	green	blue
Security	blue	
Emergency	red	yellow
Building HVAC		
Controls (<50V)	orange	
PLC I/O Digital	white	grey
PLC I/O Analog	white	blue

- .4 For power cables to electrical equipment, indicate designated name of equipment and designated name of power source (i.e., Fuel Pump #1 - fed from MCC #1).
- .5 Where more than one cable terminates at a device, add cable number (i.e., -1, -2) to end of cable identification.
- .6 Use Electrovert PVC K-marking sleeves (black on yellow), complete with PVC carrier strip and self-locking nylon cable ties (black) or approved equal.

1.16 WIRING TERMINATIONS

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

1.17 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible after equipment is installed.

1.18 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department.
- .2 Porcelain enamel signs, minimum size 180 mm x 250 mm.

1.19 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with the Drawings and these Specifications.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of equipment at no extra cost or credit, providing distance does not exceed 3 m and information is given before installation.
- .4 Locate light switches on latch side of doors.
- .5 Locate disconnect devices on latch side of doors.

1.20 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: 1350 mm.
 - .2 Wall receptacles:
 - .1 General: 450 mm.
 - .2 Elevated mounting in process areas: 1200 mm.
 - .3 Above top of counters or counter splash backs: 150 mm.
 - .4 Outdoors: 1200 mm above finished grade.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telecommunications outlets: 450 mm.
 - .5 Thermostats: 1500 mm AFF.

1.21 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 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.

1.22 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Arrange and pay for holes through exterior walls; provide flashings and make weatherproof.

1.23 FIRESTOPPING

- .1 Provide firestopping and smoke sealing of all cable, cabletrough or conduit penetrations through fire resistant separations in accordance with specification Section 07 84 00 – Firestopping and Smoke Seals.

1.24 FIELD QUALITY CONTROL

- .1 Conduct and pay for following tests:
 - .1 Power distribution system including phase rotation, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, and associated control equipment including sequenced operation of systems where applicable.

- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
 - .1 Diesel generator installation.
 - .2 Electric load bank.
 - .3 Transfer switch.
- .3 Insulation resistance testing:
 - .1 Megger circuits, feeders and distribution equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and distribution equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
 - .4 Provide a type written tabular report indicating test results.
- .4 Provide a type written tabular report indicating the normal field measured load current for all motors, indicating the motor circuit protector trip setting or fuse type/rating, the overload heater element sizes and/or settings. Indicate the motor nameplate current.
- .5 Advise the Departmental Representative of dates when testing will take place. Provide five (5) days' notice of such tests.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for the Departmental Representative's review and approval.

1.25 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 The Departmental Representative will provide settings for new breakers. Set breaker settings accordingly and provide test results for the settings.

1.26 QUALITY ASSURANCE

- .1 Instructions:
 - .1 Interferences: electrical drawings are generally of a diagrammatic nature. Plan and coordinate the work to eliminate interferences with other trades. Provide all necessary raceway offsets, fittings, and boxes, adjust all fixture and equipment boxes, adjust all fixture and equipment locations and provide all supporting materials required for a planned, coordinated and neat installation. Where interferences occur, the Departmental Representative will decide which item must be relocated regardless of which was installed first.

- .2 Electrical workmanship: provide workmanship of the highest quality. Sub-standard work will not be accepted. Use only persons skilled in the trades involved.
 - .3 Electrical materials: provide all materials used in this work, unless particularly specified otherwise, that are new, free from flaws, or imperfections.
 - .4 Sleeves and inserts: furnish and locate all sleeves and inserts required for this work in accordance with drawings.
- .2 Applicable standards:
- .1 All electrical work must conform to the requirements and recommendations of the latest edition of the Canadian Electrical Code and all local codes and ordinances. In conflicts between codes, the more stringent requirements will govern.
 - .2 In no instance will the standard established by this specification be reduced by any of the codes or standards referred to in this specification.
 - .3 Standards: the specifications and standards of the following organizations are by reference made as part of these specifications and all electrical work, unless otherwise indicated, shall comply with their requirements and recommendations wherever applicable.
 - .4 Canadian Standard Association (CSA).
 - .5 Illuminating Consultants Society (I.E.S.).
 - .6 Institute of Electrical and Electronics Engineers (I.E.E.E.).
 - .7 Instrument Society of America (I.S.A.).
 - .8 American Society for Testing Materials (A.S.T.M.).
 - .9 Certified Ballast Manufacturers (C.B.M.).
 - .10 Insulated Power Cable Consultants Association (I.P.C.E.A.).
 - .11 Electrical Equipment Manufacturer's Association of Canada (E.E.M.A.C.).
 - .12 National Fire Protection Association (N.F.P.A.).
 - .13 Underwriter's Laboratories of Canada (U.L.C.).
 - .14 Joint Industrial Council (J.I.C.).
 - .15 All local and provincial codes and ordinances.

1.27 RECORD DRAWINGS

- .1 Record Drawings:
 - .1 Provide a set of full-sized drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by the Departmental Representative.
 - .2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by the Departmental Representative.
 - .3 On completion of Work and prior to final inspection, submit record documents to the Departmental Representative.
 - .4 Refer to Section 01 78 00 – Closeout Submittals for more details.

1.28 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all debris and waste materials at appropriate disposal/recycling facilities.
- .2 Separate and recycle waste materials in accordance with applicable Construction/Demolition Waste Management and Disposal Regulations.
- .3 Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal for additional requirements for disposal and recycling.

END OF SECTION