

PART 1 - GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 26.
- .2 This section supplements requirements of Division 01, Division 23, Division 33 and Division 34.
- .3 This section describes general requirements for the electrical systems installation.
- .4 Coordinate with the installation of the new power service for LTWMF site as requirement.
- .5 Existing substation with 1000KVA transformer owned by Cameco shall remain and provide service for permanent power supply for PGWMF site and temporary power supplies for Contractor.
- .6 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 in accordance with Manufacturer's written instructions and code requirements for spacing with primary regard for usage of wall space, convenience of operation and grouping of devices.

1.2 MEASUREMENT AND
PAYMENT

- .1 Payment for provision of all items specified in this Section shall be by Lot Price. No separate payment will be made for work specified in the Contract Documents. All costs incurred by Contractor in meeting with the requirements of this Section shall be included in the bid price for the Work.

1.3 REFERENCES

- .1 CSA C22.1-2012 Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA C22.2 No. 0-10 - General Requirements - Canadian Electrical Code Part II.
 - .3 CAN/CSA-22.3 No. 1-10, Overhead Systems
 - .4 CAN/CSA C22.3 No.7-10, Underground Systems.
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1.3 REFERENCES (Cont'd)

- .5 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .7 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
- .8 National Electrical Manufacturers Association (NEMA)
- .9 Institute of the Electrical and Electronic Engineers (IEEE)
- .10 Insulated Cable Engineers Association (ICEA)
- .11 Underwriters Laboratories Canada (ULC)
- .12 American National Standards Institute (ANSI)
- .13 National Fire Protection Agency (NFPA)
- .14 The Ontario Electrical Safety Code 25th edition 2012, and all bulletins (Ontario).
- .15 Hydro requirements and local applicable codes and regulations.

1.4 DEFINITIONS

- .1 The following are definitions used in Division 26. Refer also to Division 01.
 - .1 Inspection Authority means agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical Site work.
 - .2 Hydro One is the electrical power company or commission responsible for delivering electrical power to project Site.
 - .3 Electrical Code or Code means the latest edition of the Ontario Electrical Safety Code.
 - .4 CEC means latest edition of the Canadian Electrical Code.

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 Operating instructions to include following:

1.5 CARE, OPERATION .2
AND START-UP
(Cont'd)

- (Cont'd)
- .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.
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- .3 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.
 - .4 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 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. 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 and French.

1.7 SUBMITTALS

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that shall be shown to ensure coordinated installation.

1.7 SUBMITTALS
(Cont'd)

- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Quality Control: in accordance with Section 01 45 00.
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, load balance report as described in PART 3 - FIELD QUALITY CONTROL.
 - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .6 Manufacturer's Field Reports: submit to Departmental Representative within 7 working days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .7 Single Line Electrical Diagrams.

1.8 VENDORS
RESPONSIBILITY

- .1 It shall be the Vendors responsibility to be knowledgeable of the requirements of Electrical Standards and Codes.
- .2 All installation work will be carried out in accordance with Canadian Standards and Codes.
- .3 The latest revision of applicable standards, specifications and codes will be used. In the event of a conflict between the requirements of this document and the relevant standards or specifications, the more stringent requirement will take precedence.
- .4 System target power factor to be 0.9 to 0.95 lagging.
- .5 Relative humidity: 20 to 95 percent.

1.8 VENDORS
RESPONSIBILITY
(Cont'd)

- .6 Voltage rate of Equipment: 120V, 208V or 600V shall be acceptable.

1.9 WASTE
MANAGEMENT
AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .2 Collect, package and store expired motors for either recycling or rebuilding and return to recycler or rebuilder.
- .3 Contractor will manage all waste in accordance with Environmental Protection Plan (EPP).

1.10 MAINTENANCE

- .1 Provide in accordance with the requirements of Section 01 78 00:
 - .1 2 of each spare cartridge fuses for each type used on the project.
 - .2 3 of each spare lamps for each processing area fixtures.
 - .3 4 of each spare fluorescent tubes for every size used.
 - .4 4 of each spare lamps for the external pole mounted fixtures.
 - .5 Spare elements for the building mounted lights.

1.11 PERMITS, FEES
AND INSPECTION

- .1 Submit to Electrical Safety Authority (ESA) necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Departmental Representative will provide drawings and specifications required by Electrical Safety Authority (ESA) at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Safety Authority (ESA) prior to making changes.
- .5 Furnish Certificates of Acceptance from Electrical Safety Authority (ESA) or authorities having jurisdiction on completion of work to Departmental Representative.

1.12 COORDINATION

- .1 Co-ordinate works with work of other divisions to avoid conflict.

1.12 COORDINATION
(Cont'd)

- .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
- .3 Locate all existing underground services and make all parties aware of their existence and location.
- .4 Where interference occurs, Departmental Representative shall approve relocation of equipment and materials regardless of installation order.
- .5 Notwithstanding the review of shop drawings, Division 26 may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by Division 26. The cost of this relocation shall be the responsibility of this Division. The Departmental Representative shall decide the extent of relocation required.
- .6 Work provided under Division 26 - Electrical
 - .1 Unless, indicated otherwise in the Contract Documents, all control panels shown on the Contract Drawings. All control panels by vender package shall be constructed in accordance with P&ID drawings and specification.
 - .2 All control and 120 V power wiring required by Division 40 90 00 - (see P&ID drawings and section 40 90 00 and Device Control wiring diagram).
 - .3 Installation of control panels and electrical devices supplied by other divisions.
 - .4 Installation of pre-purchased control panels and electrical equipment and devices in accordance with Division 01.

1.13 CUTTING AND
PATCHING

- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 03. Obtain written approval of Structural engineer before drilling any beams or floors.

1.14 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.15 RECORD
DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.
- .2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.
- .3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.
- .4 Submit record drawings within 30 days prior to start of commissioning.

1.16 INSPECTION OF
WORK

- .1 The Departmental Representative will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.17 SCHEDULING OF
WORK

- .1 Work shall be scheduled in phases in accordance with the Construction Milestone Schedule.
 - .2 Become familiar with the phasing requirements for the work and comply with these conditions.
 - .3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.
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| <u>1.18 FIRE RATING OF
PENETRATIONS</u> | .1 | Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls. |
| | .2 | Use fire barrier products at each penetration, to meet ULC standards. |

PART 2 - PRODUCTS

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| <u>2.1 ELECTRIC
MOTORS, EQUIPMENT
AND CONTROLS</u> | .1 | Supplier and installer responsibility is indicated in Motor Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings, where applicable. |
| | .2 | Control wiring and conduit: in accordance with Section 26 29 03 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical and instrumentation sections and as shown on mechanical and instrumentation drawings. |

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| <u>2.2 WOOD POLES</u> | .1 | All work, materials and supplied equipment shall be provided, constructed, inspected and tested in accordance with OPSD-2238.01 and OPSD 2235.01 as indicated on the drawings. |
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| <u>2.3 MATERIALS AND
EQUIPMENT</u> | .1 | Provide materials and equipment in accordance with Section 01 61 00. |
| | .2 | Equipment and material to be CSA certified. |
| | .3 | Factory assemble control panels and component assemblies. |
| | .4 | Unless otherwise indicated in the contract documents, manufacture to the standards of North American Standards Agencies. |

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| <u>2.4 FINISHES</u> | .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. |

2.5 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Safety Authority and Departmental Representative.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.6 WIRING
TERMINATIONS

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

2.7 EQUIPMENT
IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.
 - .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 Labels:
 - .1 Embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wordings on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate and label.
- .5 Identification to be English and French.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system name and voltage.

2.7 EQUIPMENT
IDENTIFICATION
(Cont'd)

- .9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

2.8 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, Canadian Electrical Code.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.9 CONDUIT AND
CABLE
IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed 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 20 mm wide auxiliary colour.

Conduit System	Prime Color	Auxiliary Color
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

PART 3 - EXECUTION

3.1 NAMEPLATES AND
LABELS

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

3.2 LOCATION OF
OUTLETS

- .1 Locate outlets in accordance with Section 26 27 26.
- .2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised to suit construction and equipment arrangements without additional cost to the Departmental Representative.
- .3 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.
- .4 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .5 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .6 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.
- .7 Maintain luminaire locations where possible. Notify the Departmental Representative of conflicts with other services.

3.3 CONDUIT AND
CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, 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 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
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3.3 CONDUIT AND
CABLE INSTALLATION
(Cont'd)

- .4 All spare conduits and sleeves shall be capped for future use.

3.4 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 wall mounted electrical at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets in mechanical room: 300 mm.
 - .5 Wall mounted telephone and interphone outlets in services room: 1400 mm.
 - .6 Fire alarm pull stations: 1200 mm.
 - .7 Fire alarm bells: 2400 mm.
 - .8 Television outlets: 300 mm.
 - .9 Wall mounted speakers: 2400 mm.
 - .10 Clocks: 2400 mm.
 - .11 Door bell pushbuttons: 1200 mm.
 - .12 Exit lights: 2400 mm or as indicated.
 - .13 Emergency lighting heads: 2400 mm.
 - .14 Motor starter, generally: 1400 mm.

3.5 COORDINATION
WITH OTHER
DIVISIONS

- .1 Examine the drawings and specifications of all divisions and become fully familiar with their work. Before commencing work, obtain a ruling from the Departmental Representative if any conflict noticed.
 - .2 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.
 - .3 Do not cut structural members without approval of the Departmental Representative.
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3.5 COORDINATION
WITH OTHER
DIVISIONS
(Cont'd)

- .4 Coordinate with all Divisions installing equipment and services, and ensure that there are no conflicts.
- .5 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.
- .6 Examine previously constructed work and notify the Departmental Representative of any conditions which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

3.6 COORDINATION OF
PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .2 All the settings to be in accordance with approved coordination study.

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.
- .2 In particular, contact between dissimilar metals, such as copper and aluminium, 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 Departmental Representative and the ceiling installer, and approved clips or hangers are used.

3.8 FIELD QUALITY
CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices in accordance with the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province of Ontario.
- .3 Perform tests in Accordance with this section as noted and Section 01 91 13.
- .4 Load Balance:
 - .1 Measure phase current to panelboard 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.
- .5 Conduct and pay for tests to include but not limited to the following:
 - .1 Power generation and 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 operations of systems where applicable.
 - .5 Systems: fire alarm system, communications.

3.8 FIELD QUALITY
CONTROL
(Cont'd)

- .6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to Manufacturer's written instructions.
- .7 Insulation resistance testing.
 - .1 Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger and record 350 - 600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing and record value.
- .8 Carry out tests in presence of Departmental Representative.
- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.
- .10 Lighting Systems:
 - .1 Test, circuits for operation of devices, switches and controls.
 - .2 Measure Normal and Emergency lighting Lux levels throughout buildings at night.
- .11 Receptacle Circuits:
 - .1 Carry out polarity test on all receptacles.
- .12 Supply Voltages:
 - .1 Measure line voltages of each phase at load terminal of main breakers make test with most electrical loads connected.
- .13 Motor Loadings:
 - .1 Prior to energizing pump test each motor to ensure correct phase rotations.
 - .2 Measure line voltages and current draw on each phase, ensure each line is balanced.
- .14 Grounding:
 - .1 Conduct resistance tests on both the lightning protection system and Grounding systems.
- .15 Submit test results for Departmental Representative's review and include in Commissioning Manuals specified in Section 01 91 13.

3.9 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 Clean all internal surfaces and remove all debris prior to commissioning all switchboards, distribution panels and transformers.
- .4 Ensure all light fixtures are cleaned and free from debris prior to handover.