

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian Standards Association (CSA International)
 - .1 Latest edition of CSA C22.1, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No. 1-01 (Update March 2005), Overhead Systems.
 - .3 CAN3-C235-83 (R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 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.
- 1.2 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.
- 1.3 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.
 - .4 The installation shall meet all general industry practices, which may be above the minimum requirements set by statutory codes and regulations. Installation is to be performed to permit ease of maintenance and operation. Capacity of electrical system shall include a 100% allowance for installed lighting with appropriate demand for other loads and planned future expansions; an
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1.3 DESIGN
REQUIREMENTS
(Cont'd)

- .4 (Cont'd)
additional allowance of 10% will be allowed
for load growth over the life of the
installation.
- .5 The scope of work is to install all major
electrical distribution in the storage
building including but not limited to the main
panel, starters, raceways, disconnect
switches, cables and conductors, lighting,
lighting control and power distribution.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section
01 33 00 - Submittal Procedures.
 - .2 Product Data: submit WHMIS MSDS.
 - .3 Shop drawings:
 - .1 Submit drawings stamped and signed by
professional engineer registered or licensed
in Province of Newfoundland and Labrador,
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 must be shown to ensure
co-ordinated installation.
 - .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 of drawings clearances for
operation, maintenance, and replacement of
operating equipment devices.
 - .5 If changes are required, notify
Departmental Representative of these changes
before they are made.
 - .4 Quality Control: in accordance with Section
01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and
material.
 - .2 Where CSA certified equipment and
material is not available, submit such
equipment and material to inspection
authorities for special approval before
delivery to site.
 - .3 Submit test results of installed
electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with
General Conditions of contract.
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- 1.4 SUBMITTALS
(Cont'd)
- .4 Quality Control: (Cont'd)
- .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 Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- 1.5 QUALITY ASSURANCE
- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices 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 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 Twice during progress of Work at 25% and 60% 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 35 30 - Health and Safety Requirements.
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1.6 DELIVERY,
STORAGE AND
HANDLING

.1 Material Delivery Schedule: provide Departmental Representative Engineer Consultant with schedule within 2 weeks after award of Contract.

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

1.7 SYSTEM STARTUP

.1 Instruct Departmental Representative 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 with aspects of its care and operation.

1.8 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.

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| 1.8 OPERATING INSTRUCTIONS
(Cont'd) | .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. |

PART 2 - PRODUCTS

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| 2.1 MATERIALS AND EQUIPMENT | .1 | Provide material and equipment in accordance with Section 01 61 00 - Common Product 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. |

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| 2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS | .1 | Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated. |
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| 2.3 WARNING SIGNS | .1 | Warning Signs: in accordance with requirements of authority having jurisdiction. |
| | .2 | Porcelain enamel decal signs, minimum size 175 x 250 mm. |

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| 2.4 WIRING TERMINATIONS | .1 | Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors. |
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2.5 EQUIPMENT
IDENTIFICATION

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

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

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	1	line	3 mm high letters
Size 2	1	line	5 mm high letters
Size 3	1	lines	3 mm high letters
Size 4	2	line	8 mm high letters
Size 5	2	lines	5 mm high letters
Size 6	2	100 mm 1 line	12 mm high letters
Size 7	2	100 mm 2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. " as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

- 2.5 EQUIPMENT IDENTIFICATION (Cont'd)
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
 - .9 Transformers: indicate capacity, primary and secondary voltages.

- 2.6 WIRING IDENTIFICATION
- .1 Identify wiring with permanent indelible identifying markings, numbered 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 coding: to CSA C22.1.
 - .4 Use colour coded wires in communication cables, matched throughout system.

- 2.7 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.

	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	Green	Blue
Communication Systems		
Fire Alarm	Red	
Emergency	Red	Blue
Voice		
Other	Red	Yellow
Security Systems		

- 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 to.
- .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.
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- 2.9 DISTRIBUTION .1 Equipment including panels, splitters, individual starters, disconnect switches, raceways, cables and conductors.
- .2 Equipment to be rated for service to which it is applied; including voltage class, continuous current rating, interrupting and environmental conditions.
- .3 Buss bars in panels and splitters to be copper.
- .4 panelboard overcurrent protection to be bolt-on molded case circuit breakers.
- .5 Main distribution panel to be 100A, 347/600V, 3 phase, 4 wire type with bolt-on molded case circuit breakers. Main panel to be lockable and contain spares and spaces. Locate near entrance to building.
- .6 Main distribution panel to be fed with a new 100A, 3P breaker in the existing emergency distribution panel Section B of the 600V panel in the Air Terminal Electrical Room. Provide 4 #3 RWU90 copper conductors plus 1 #6 ground in 53 mm conduit to the new distribution panel. Contractor to note that an existing feeder is installed underground in the location of the new storage shed. This feeder formerly fed the Fire Training Area and is no longer in use.
- .7 30 KVA, 600: 120/208V, 3 ϕ , 4W transformer to be fed from a new 40A, 3P breaker in the 600V distribution board. Run 3 #8 RW90 copper conductors plus 1 #10 board in 21 mm conduit from 40A, 3P breaker to transformer primary. Transformer to be epoxy encapsulated, designed for indoor and outdoor applications. Transformer to be wall mounted above panel. Run 1 #6 green ground from transformer to main building ground.
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- 2.9 DISTRIBUTION .8 200A, 120/208V, 3 ϕ , 4W distribution to be fed from new 30 KVA transformer. Run 4 #2 RW90 plus 1 #6 bond in 35 mm conduit from transformer secondary to new 120/208 V distribution.
- (Cont'd)
- .9 Magnetic motor starters will have the following features; over load protection in all phases (solid state, incorporating single phase protection, for motors 5hp and above); disconnect and over current devices; H-O-A switch for motors with automatic control; LED type pilot lights; auxiliary control and status devices as required for interface with other systems; nominal 120V control voltage including control transformer and protection as required.
- .10 Raceways to be ENT, rigid steel, and flexible conduit (dry and liquid tight) with associated fittings, clamps, supports, junction and outlet boxes. Empty raceways shall be provided for telephone, data wiring and security system. All raceways to contain and insulated green bonding conductor sized to CEC but not less than #12 AWG copper.
- .11 Conductors used in raceway to be 600V RW90, XPLE insulated stranded copper conductors; minimum size #12 AWG.
- .12 Armoured cable to type AC90, 600V XPLE insulated stranded copper conductors to be used for lighting drops and vibrating equipment only; minimum size #12 AWG, containing integral copper bonding conductor. Only approved connector's clamps, supports and accessories for AC90 are acceptable.
- .13 Fused and non fused disconnect switches as required for local protection and isolation.
- 2.10 WIRING DEVICES .1 Toggle switches, convenience receptacles, ground fault circuit interrupting receptacles, appliance receptacles, and special receptacles and associated accessories. Housekeeping receptacles to be placed within the interior of the storage room and weatherproof GFIC receptacles to be installed near the entrances and overhead doors.
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2.10 WIRING DEVICES .2
(Cont'd)

- All wiring devices to be industrial specification grade and CSA standard configurations, Receptacles to be 15A and 20A 120V duplex U-ground style with Class A leakage current protection.
- .3 Nylon cover plates for all recessed devices to match rating and style; galvanized steel covers for devices installed in surface mounted utility boxes; cast covers for devices mounted in cast boxes; PVC weather proof covers for devices mounted outdoors. All wiring devices to be properly identified by panel and circuitry.

2.11 INTERIOR
LIGHTING

- .1 Lighting levels will be as stated in the IESNA recommended practices for specific spaces or as indicated. Average floor level illumination not to be less than 200 lux.
- .2 General interior lighting will be provided by T5 fluorescent industrial reflector fixtures or metal halide medium bay fixtures with wire guard protection.
- .3 Fluorescent lamps driven by Class P electronic energy saving ballasts, rated for -29 degrees celsius, 3500 K color temperature, 85 CRI.
- .4 All lighting fixture types will be supplied at 120V.

2.12 EXTERIOR
LIGHTING

- .1 Lighting levels will be as stated in the IESNA recommended practices for specific spaces or as indicated. Average floor level illumination not to be less than 50 lux at main entrances.
- .2 General exterior lighting will be provided by high pressure sodium wall packs, 3500 K color temperature. Complete with UL listed HID high power factor ballasts, Class H insulation rated for -40 degrees celsius.
- .3 All lighting fixture types will be supplied at 120V.

- 2.13 UNIT HEATERS
- .1 Heating for the building will be provided by electric unit heaters. Heating system will be designed for shell heat loss of 40 KW.
 - .2 Unit heater: to CSA C22.2 No. 46, horizontal discharge complete with adjustable louvers finished to match cabinet or vertical discharge cone type with cone diffusers as indicated.
 - .3 Fan type unit heaters with built-in limit protection, fan-delay switches.
 - .4 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount.
 - .1 Built-in fan motor thermal overload protection.
 - .5 Elements: mineral insulated steel sheath with aluminum, continuous helical brazed fins.
 - .6 Cabinet: steel, 1.6 mm thick, fitted with brackets for rod or wall mounting.
 - .1 Phosphatized and finished with 2 coats baked enamel in beige colour.
 - .7 Heaters to be 347 V or 600 V.

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 NAMEPLATES AND LABELS
- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.
- 3.3 CONDUIT AND CABLE INSTALLATION
- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
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- 3.3 CONDUIT AND CABLE INSTALLATION
(Cont'd)
- .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.
- 3.4 LOCATION OF OUTLETS
- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.
.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.
- 3.5 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: 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: 175 mm.
.4 In mechanical rooms: 1400 mm.
.3 Panelboards: as required by Code or as indicated.
.4 Telephone and interphone outlets: 300 mm.
.5 Wall mounted telephone and interphone outlets: 1500 mm.
.6 Door bell pushbuttons: 1500 mm.
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| 3.6 CO-ORDINATION
OF PROTECTIVE
DEVICES | .1 | Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. |
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| 3.7 FIELD QUALITY
CONTROL | .1 | <p>Load Balance:</p> <p>.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.</p> <p>.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.</p> <p>.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.</p> <p>.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.</p> <p>.1 Power distribution system including phasing, voltage, grounding and load balancing.</p> <p>.2 Circuits originating from branch distribution panels.</p> <p>.3 Lighting and its control.</p> <p>.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.</p> <p>.5 Insulation resistance testing:</p> <p>.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.</p> <p>.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.</p> <p>.3 Check resistance to ground before energizing.</p> <p>.3 Carry out tests in presence of Departmental Representative.</p> <p>.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.</p> <p>.5 Manufacturer's Field Services:</p> <p>.1 Obtain written report from manufacturer verifying compliance of Work, in handling,</p> |
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- 3.7 FIELD QUALITY CONTROL
(Cont'd)
- .5 Manufacturer's Field Services:(Cont'd)
- .1 (Cont'd)
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.
- 3.8 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.