

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 This section includes common requirements to various sections of the "Electricity" discipline.
- .2 The architecture specifications section, clauses, and general conditions of the project and the general mechanics specifications are integral parts of this section.
- .3 The listing given in this document is non limiting and all required devices or accessories for a complete installation shall be supplied and installed by the contractor even if they are not specifically described.
- .4 In the case of non compliance or contradiction between all the documents, the most restrictive clauses will have priority.

1.2 REFERENCES

- .1 Unless otherwise specified, where a code or standard are mentioned in the tender documents, the latest edition with its subsequent modifications in force at the time of construction is to be used.
- .2 Provincial codes and regulations of the Department of Public safety.
- .3 Construction and zoning regulations and provincial codes.
- .4 Applicable regulations from Protection Services of the Ministry of Environment.
- .5 Execute the entire installation in accordance with the Canadian Electrical Code Handbook, Part 1.
- .6 All the equipment, installation, and testing shall be in compliance with standards, codes and regulations of Federal, Provincial and Municipal Governments.
- .7 All equipment, testing and quality assurance shall be in compliance with standards and codes of the following associations:

Canadian Standards Association (CSA International)

- .1 CSA C22.1, Canadian Electrical Code, Part 1 (current Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2.
- .3 CAN/CSA-C22.3, Overhead Systems.
- .4 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

And all regulations and recommendations applicable in New Brunswick.

EEMAC: Electrical and Electronic Manufacturer's Association of Canada

EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.

ANSI: American National Manufacturer's Institute.

NEMA: National Electrical Manufacturer's Association.

IEEE: Institute of Electrical and Electronics/National Electrical Safety Code Product Line (NESC).

- .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms.

ICEA: Insulated Power Cable Engineers Association

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 standards.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 All electric equipment shall also operate within limits of supply of electricity from the power company.
- .4 In any event, equipment shall operate normally and with minimal voltage variation of -15% and +10%.

- .5 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- 1.4 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 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 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts.
- .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, in appropriate NMS Section, 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 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 29.06 - Health and Safety Requirements.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Material Delivery Schedule: provide the Engineer a 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.
- .3 Material shall be delivered and stored following manufacturer's instructions and ensure that their seals and labels are intact.
- .4 Store electric material indoor, unless otherwise specified.

1.6 SYSTEM STARTUP

- .1 Explain to the Engineer and the operating personnel in operation, systems care and maintenance, system equipment and components.
- .2 All devices and various systems shall be turned on, adjusted and calibrated by the contractor in order to obtain the required capacity and performance specified in drawings and specifications.
- .3 Retain and pay for the services of an engineer seconded to the manufacturer's plant to monitor the startup of the facility, to check, adjust, calibrate and balance the various elements and to instruct the operating personnel.
- .4 Provide these services for a sufficient time, forecasting the number of visits necessary to put the devices on and ensure that operational staff are familiar with all aspects of their maintenance and operation.

1.7 OPERATION INSTRUCTIONS

- .1 Provide three (3) copies of the manual of operation and maintenance in a binder for this purpose. These manuals will be composed of a hardcover with three rings and identified by a "P-Touch" on the front and side.
- .2 Operation and maintenance data sheets shall contain the following information:
 - .1 Components details, construction characteristics, maintenance functions and requirements of various components to ease commissioning, operation, maintenance, repair and modifications.

- .2 Technical data and product specifications shall be accompanied by supplementary information such as newsletters, illustrations and different views, technical descriptions and parts lists. Advertising flyers and brochures are not accepted.
- .3 A copy of each shop drawing revised with comments received during their approval and modifications during construction.
- .4 Warranties and test reports conducted in factories and on-site, verification certificates, circuit breakers certificate, etc.
- .5 Data sheets shall be in French and English.
- .3 Training courses shall be based on the content of operation and maintenance manual and as-built drawings.

1.8 WARRANTY

- .1 Unless a specific requirement for plans and specifications for an extended warranty, all equipment used will be warranted for a period of one year from the date of provisional acceptance of work.
- .2 This warranty will cover costs of required parts and labor to allow the operation of equipment.

1.9 RIGHTS, PERMITS AND INSPECTION

- .1 Provide to the authorities concerned the desired number of copies of drawings and specifications to allow them to study and approve them before the work begins.
- .2 Pay all associated costs.
- .3 The contractor is responsible to make the connection application to the electricity distributor.
- .4 If applicable, drawings and specifications required by authorities will be provided directly by the contractor at his costs.
- .5 At the end of works, supply required certificates including a copy to the engineer. Pay all costs for additional copies required by the concerned authorities.

1.10 LOW-EMITTING
MATERIALS

- .1 Adhesives and cleaning products used in the building shall be in compliance with VOC (volatile organic compounds) limits established by the regulation "South Coast Air Quality Mangement District Rule #1169" (U.S.A.).
- .2 All sealants and cleaning products used in the building shall be in compliance with requirements of article 51 of regulation "Bay Area Air Quality Management District Reg. 8" (U.S.A).
- .3 Paints, coatings and cleaning products used in the building shall respect or be inferior to VOC limits and of chemical components established by the Green Seal program.

PART 2 – PRODUCTS

2.1 SUSTAINABLE
REQUIREMENTS

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

2.2 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 and from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.
- .4 Provide materials, equipment and new assemblies, of design and proven quality, of recent model, whose characteristics are known and whose replacement parts are available upon request.
- .5 Determine and respect manufacturer's recommendations relating to storage and material installation.

2.3 ELECTRIC
MOTORS, EQUIPMENT
AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated. Unless otherwise specified, starters are supplied and installed by the "Electricity" department. The mechanic section supply and install engines and related equipment.
- .2 Ensure that the phase sequence is adequate to allow the driving forces to have clockwise rotations.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities and with the Engineer.

2.5 WIRING
TERMINATIONS

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

2.6 EQUIPMENT
IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: plastic laminate lamicaid 3 mm (1/8in) thick plastic engraving sheet, black lettering accurately aligned and engraved into 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: embossed plastic labels with 6mm high letters unless specified otherwise.

- .3 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .4 Nameplates for terminal cabinet and junction boxes must include the characteristics of the network and / or voltage, the identification panel and the circuit from which the supply comes from and indicate what is being supplied ownstream (after).
- .5 Entries shall be in French and English
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Transformer nameplates shall indicate the identification.
- .8 Secondary panels 120/208V and 120/240V and 347/600V:
 - .1 Install lamicoid plates in order to indicate the equipment, where the supply comes from and the circuit numbers.
- .9 Electric devices:
 - .1 All panels, switchgears, circuit breakers, junction and pulling boxes, starters, contactors, each main circuit boards and other equipment provided by this division will each carry an identification plate engraved in lamicoids in white on a black background according to the formats given in section 2.6.1.2 of this section. This identification corresponds to that shown on the drawings.
- .10 List of signaling plates formats to be used:
 - .1 Main branch table : 7
 - .2 Junction and pulling box 5
 - .3 Contactor: 5
 - .4 Magnetic starters: 5
 - .5 Manual starters: 5
 - .6 Main circuit breakers: 5
 - .7 Disconnectors: 5
 - .8 Transformers: 5

.9 Distribution Panel: 5

.11 Boxes

.1 All junction and pulling boxes used for branch circuits will be identified as follows: number of electric panel and number of circuits. The inscription shall be done using a "P-Touch".

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings 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 coding according to Canadian Electrical Code Handbook, Part 1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 In each panel and in all junction boxes, each conductor will be identified by the panel number with identifications of brand P. & S., type "CAB3" or type "C" of the Electrovert.

2.8 CONDUIT AND CABLE IDENTIFICATION

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

.2 Use plastic tape as a means of identification, the cables or pipes every 15 ft and crossing points of the walls, ceilings and floors. Paint tags are strictly prohibited.

.3 Colours: 50 mm wide for prime colour and 25 mm wide for auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Grounding	Green	White
Telephone	Green	

2.9 FINISHES

.1 For all electrical equipment, the surfaces of metal enclosures shall be finished in a workshop and be coated with an anti-rust finish , both inside and outside, of at least 2 coats of enamel paint finish, gray ASA-61 according to standards in force and to standard EEMAC 2Y-1.

- .2 Clean and retouch painted surfaces in workshop that had been scratched or damaged during shipment or installation. Use paint matching the original paint.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with the Canadian Electrical Code Handbook.

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 All work described below concerning the installation of coupling sleeves, piercing or opening obstructions in a new construction will be executed by
- The electrical contractor for the required opening for installation of a conduit of at least 150mm (6 po) in diameter.
 - The general contractor for all other opening of greater diameter.
- .2 Piercing works include piercings of foundations, enclosures, floors, interior walls, as well as necessary drillings for the installation of equipment, conduits and of their supports, inserts and nuts.
- .3 Install coupling sleeves in areas where conduits cross masonry and concrete works.
- .4 All coupling sleeves, inserts and nuts, etc, will be installed before walls and floors are constructed and before the concrete is poured.
- .5 Use steel pipes as coupling sleeves, schedule 40, with anchors fixed in the center, of 12mmø more than the conduits. Steel sleeves welded 16-gauge, may be used only when the required inside diameter of the sleeve will not match a standard diameter pipe schedule 40. Apply before the installation a layer of paint dry zinc (product accepted: Sico "Corrostop).

- .6 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.
- .7 The piercing of holes with a pneumatic hammer, with a hammer of electric vibratory action, piercing by hand and any other process by mechanical shocks are prohibited. Holes shall be pierced using a rotary drill with water or any other device accepted by the engineer.
- .8 At exterior walls and water basins crossings, using sleeves with a collar attached to the center by continuous welding.
- .9 Dimensions: leave a free ring space of at least 12mm between the sleeve and the pipe without insulation or between the sleeve and the insulation.
- .10 Install sleeves so they are flush with concrete and masonry surfaces, and concrete floor poured directly onto the ground and so they exceed 50mm every other floor types.
- .11 The contractor shall fill voids around conduits using prefabricated packers when sleeves go through foundation walls, exterior walls, concrete walls, sealed basin walls and slabs with liquid tight membrane. The accepted products will be of type "link seal".

3.4 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.
- .3 Locate light switches on latch side of doors. 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 centerline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify with the engineer before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1200mm.
- .2 Wall receptacles:
 - .1 General: 300mm.
 - .2 In mechanical rooms: 1200mm.
- .3 Panelboards: as required by Code (Part I) or as indicated.

3.6 PROTECTION

- .1 During construction works, protect exposed and live material to ensure safety of staff.
- .2 Lock and mark live parts by inscription "Live circuit 120 volts" (or appropriate voltage), in French and English.

3.7 COORDINATION
OF PROTECTIVE
DEVICES

- .1 The contractor shall conduct a coordination study. This study shall include all curves on logarithmic paper showing the coordination between existing protections at connection points and between protection devices of electric installation covered in this section.
- .2 The contractor shall get the approval for this study by the engineer.
- .3 When the study is approved, the contractor shall adjust and install all protection devices such as overload strips, relays and fuses. The contractor shall verify and ensure that adjustments are set to the required values before powering up the different devices, and make a written report to the engineer.

3.8 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 45 00 - Quality Control.
 - .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 operation of systems where applicable.
 - .5 The system of emergency power and / or succession by a specialized firm.
 - .6 Dielectric strength test (strength test on the insulation).
 - .1 Measure, using a 500 V megger, the value of isolation circuits, cables and distribution equipment with a rated voltage not exceeding 350 V.
 - .2 Measure, using a megger 1000 V, the value of isolation circuits, arteries and appliances with a rated voltage between 350 V and 600 V.
 - .3 Verify the value of earth resistance before powering up.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 Submit test results in a written report.
- .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.

3.9 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 conduit networks and their boxes before the pulling of conductors.
- .4 Clean interior of all boxes of wiring devices for lighting and heating and special systems.
- .5 Before their activation, clean all equipment, panels, transformers, starters, etc., their control panel and their accessories

PART 1 - GENERAL

- .1 In general, drawings and specifications describe the required work such as the development, the installation, testing, required material, etc. to ensure full implementation of works. Execute in accordance with standards, laws and regulation.
- .2 The Contractor is responsible for the proper execution of all work described in drawings and specifications.
- .3 The general contractor is responsible for temporary electricity and telephone services required for himself and his subcontractors for the duration of works.
- .4 The contractor is responsible to ensure adequate coordination with subcontractors.
- .5 Specified material and apparatus set minimum quality and performance requirements.
- .6 Works are summarized, but not limited, in section 26 05 05.

1.1 REQUEST OF
ELECTRICAL SUPPLY

- .1 The Contractor shall complete a request for electrical supply and send it to the concerned utility department. In addition, the contractor shall “confirm” to the utility company that he obtained the contract, the start date of work and the anticipated date of electrical services required at the site.
- .2 Note that temporary electrical services including the request for construction, if required, are excluded from this request and are under the responsibility of the general contractor.

1.2 OTHER PUBLIC
UTILITIES

- .1 Requests for other public utilities (telephone, telecable, municipal electrical services if applicable, etc.) are under the full responsibility of the general contractor.
- .2 The general contractor is in charge of the requests of other temporary electrical services required for the construction period.

1.3 RELATION BETWEEN
ARCHITECTURE, PORT,
STRUCTURE, MECHANICAL
AND ELECTRICAL DOCUMENTS

- .1 Drawings, specifications and addendum of architecture, structure, mechanics and electricity complement one another and shall be consulted and studied jointly to take cognizance of what could affect particular works in each department. No additional amount will be paid to the contractor for not having foreseen the cost of all connection work, piercing, transportation or other similar work, that are required to erect the building structure or by devices, equipment, pipes or conduits, accessories or by any other items or work required.

1.4 ORGANIZATION OF
SPECIFICATIONS

- .1 This document covers the description and installation of all equipment normally used for the completion of all types of electricity works.
- .2 The scope of work relating to these works are described on drawings and in section 26 05 05.

PART 1 – GENERAL

- 1.1 GENERAL
- .1 Works described in this section cover electrical works to be performed.
 - .2 The contractor has to provide labour, equipment, cables, conductors, electrical conduits, documentation, machinery, scaffolding, supports, services, testing devices, material and all accessories required by the manufacturer, supply, delivery, storage, installation, connection, testing, commissioning and the equipment and material warranty for works described in this section.
 - .3 Conductors of each electrical supply shall be of the required size and section for a voltage drop of less than 3% in steady state between the transformer and all devices supplied by this transformer.
 - .4 The contractor shall examine contract documents, the work site (if necessary) and inquire in details on all conditions and limitations. Specifications and drawings shall be carefully studied. Terms and conditions included in this document shall be scrupulously respected.
 - .5 The contractor will be in charge of all works related to the lot of electricity covering the electricity work as indicated.
 - .6 The contractor shall perform in compliance with all requirements of the contract documents and shall examine the work site and obtain detailed information on all existing conditions and limitations. The contractor is supposed to know the difficulties and requirements for the works to be performed and in any case, no claims from him will be accepted if he negligently fails to comply with the requested conditions.
 - .7 The contractor shall verify all plans for each discipline as part of this project in order to thoroughly understand all connections he is responsible for. If one or more electrical devices became defective due to bad connections, the contractor in electricity will be jointly liable with the contractor providing the equipment.
 - .8 The contractor shall put in service the connected equipment in the presence of the contractor who supplied the equipment in order to prevent all malfunctions.
- 1.2 SCOPE OF WORK
- .1 Works described above are not exhaustive. These works are defined more specifically in documents and drawings. All devices or accessories required for a complete installation shall be supplied and installed even if they are not specifically described.
 - .1 Supply, install and connect all material required to accomplish the work.

Description of works:

- Decommission and dismantle the conductors network, conduits, cables, junction/pull boxes and existing related accessories as indicated in drawing E-2/4;
- Decommission and dismantle of electrical equipments connected to secondary utility stations, to various small buildings, electrical input 200A-347/600V and lighting mast c/w existing flood lamps shown in drawing E-2/4.
- Decommission and dismantle transformer 112.5kVA - 600-120 / 208V - 3Ø - 4F in the existing service building
- Provide electric equipments required for a connection 600A – 347/600V - 3Ø – 4F to energy distributor (See Appendix D – NB Power - Power Standard Construction Practices);
- Provide required electric equipment for the installation of a new power distribution 600A – 347/600V - 3Ø – 4F, for which the installation is planned in a new utility services building;
- Provide electric equipments such as lighting, wiring and heating devices and control related to new utility services building;
- Provide a network of site lighting including drums and projectors;
- Provide a network of conductors under PVC underground conduits in trenches to serve the new utility stations;
- Provide utility stations (cabinets) in galvanized steel covered a paint color and type according to be port authority and all related electric equipment, as shown in drawing E-4/4;
- Relocate and resupply an existing navigation light, as shown on drawing E-3/4;
- Connect mechanical equipments (Division 23 000).

- 1.3 GENERAL CONTRACTOR .1 It is the responsibility of the general contractor to provide material and perform the following works:
- .1 The installation of concrete required for the various bases supporting electric equipment;
 - .3 The supply and the installation of concrete cable pulling manholes;

- .4 The carrying out of trenches;
 - .5 The excavation, backfill, compaction and concreting;
 - .6 Concrete forms.
- 1.4 LIST OF SHOP DRAWINGS TO SUBMIT .1 The list of shop drawings to submit for approval is attached in Appendix « AA ».

PART 2 – PRODUCTS

- 2.1 ELECTRIC DEVICES .1 Principal electric devices are indicated in following lists; this lists is non restrictive.
- 2.2 LIST OF LIGHTING DEVICES .1 The contractor shall coordinate the voltage of lighting devices and accessories as specified in drawings.
.2 The list of lighting devices is attached in Appendix « A ».
- 2.3 LIST OF HEATING DEVICES .1 The contractor shall coordinate the voltage of heating devices and accessories as specified in drawings.
.2 The list of heating devices is attached in Appendix « B ».
- 2.4 SWTCHBOARD PANELS .1 The list of distribution panels is attached in Appendix « C ».
- 2.5 ENGINES/STARTERS .1 The list of engines/starters is attached in Appendix « D ».
- 2.6 SPECIFIC ELECTRIC DEVICES .1 The list of specific electric devices is given in form of data sheets attached in Appendix « E ».
- 2.7 LIST OF MATERIAL TO SUBMIT TO OWNER .1 The non restrictive list of elements to verify on site is attached in Appendix « BB ».

PART 3 – EXECUTION

- 3.1 NEUTRAL CONDUCTOR .1 Connect neutral conductors, each bearing the appropriate designation, to the common neutral busbar.
.2 Provide outlets and services, for each circuits, to 120VCA of its own neutral conductor and do not use common neutral for several circuits.

The derivations of lighting can be fitted with a common neutral line complying with the National Electrical Code.

3.2 BREAKING CAPACITY OF
CIRCUIT-BREAKERS

.1 The break capacity of circuit-breakers shall be established according to the following criteria:

A) At full nominal value;

B) At nominal value of integrated protection of equipment with upstream protection devices (serial protection). If the manufacturer uses the second choice, he will have to provide a proof of tests performed in a certified laboratory certifying the proper functioning of the system and mark the equipment with a plate indicating the voltage tested (KA eff. sym.) of the equipment, the specific protection device upstream, acceptable derivation devices, the panel designation and the voltage.

APPENDIX B

LIST OF HEATING DEVICES

HEATING BASEBOARD			
TYPE	WATTS	BRAND	SERIES
A	500	Ouellet Chromalox Stelpro Design	OFM (OPX *) BN N * Explosion-proof
B	750		
C	1000		
D	1250		
E	1500		
F	1750		
G	2000		
H	2250		
I	2500		

FORCED AIR HEATER			
TYPE	WATTS	BRAND	SERIES
J	4000	Ouellet Chromalox Stelpro Design	OAC
K	6000		RFV/F
			WF

WALL UNIT HEATER			
TYPE	WATTS	BRAND	SERIES
L	4000	Ouellet Chromalox Stelpro Design	OCA
M	6000		CH
N	8000		CBH
O	10000		

UNIT HEATERS			
TYPE	WATTS	BRAND	SERIES
P	2000	Ouellet Chromalox Stelpro Design	OAS (OUX *) EU (CXH *) SHU (XUH *) * Explosion-proof
Q	3000		
R	4000		
S	5000		
T	7500		
U	10000		
V	15000		
W	20000		
X	25000		
Y	30000		
Z	40000		

APPENDIX C

Panneau : **CDS-2** Voltage: **120/208** Phases **3 phase** Fils **4 fils** Barre omnibus **1200 A**
 Accessoire : Plèce : **Bâtiment de services** Disj.: **A** Capacité d'interruption **18 kA**

* Description	Autres		Moteur		Volts-Ampères			Disjoncteur		Phase			Volts-Ampères		Moteur		Autres		Description	*
	VA	171945	VA	HP	Chauf.	Éclair	Prise	Amp	CT	A	B	C	Prise	Éclair	Chauf.	HP	VA	VA		
Panneau "PDS-2"								600	1	A									Espace	
Espace									3	B									Espace	
Espace									5	C									Espace	
Espace									7	A								147340	Panneau "PDS-4"	
Espace									9	B									Espace	
Espace									11	C									Espace	
Espace									13	A									Espace	
Espace									15	B									Espace	
Espace									17	C									Espace	
Espace									19	A									Espace	
Espace									21	B									Espace	
Espace									23	C									Espace	
Espace									25	A									Espace	
Espace									27	B									Espace	
Espace									29	C									Espace	
Espace									31	A									Espace	
Espace									33	B									Espace	
Espace									35	C									Espace	
Espace									37	A									Espace	
Espace									39	B									Espace	
Espace									41	C									Espace	
		171945							41	Neutre								147340		

Grand total 319 285 Volts-Ampères **Total** 886 Ampères

ELECTRICITY – SCOPE OF WORK,
DESCRIPTIONS AND LISTS

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APPENDIX C

Panneau : **PDS-1** Abrév : Voltage: **120/208** Phases 3 phase Fils 4 fils Barre omnibus 600 A
 Accessoire : Pièce : Bâtiment de services Disj.: A Capacité d'interruption 18 kA

* Description	Autres		Moteur		Volts-Ampères		Disjoncteur		Phase		Disjoncteur		Volts-Ampères		Moteur		Autres		Description	*
	VA	VA	VA	HP	Éclair	Chauf.	Prise	CT	Amp	CT	A	B	C	Éclair	Chauf.	VA	HP	VA		
îlot #6							28820	100	1	A									Espace	
Pise service 100A-3phases									3	B									Espace	
Espace									5	C									Espace	
Espace									7	A									îlot #6	
Espace									9	B									Pise service 100A-3phases	
Espace									11	C									Espace	
îlot #6							17290	60	13	A									Espace	
Pise service 60A-3phases									15	B									Espace	
Espace									17	C									Espace	
Espace									19	A									Espace	
Espace									21	B									Espace	
Espace									23	C									Espace	
îlot #6							17290	60	25	A									Espace	
Pise service 60A-3phases									27	B									Espace	
Espace									29	C									Espace	
Espace									31	A									Espace	
Espace									33	B									Espace	
Espace									35	C									Espace	
îlot #6 panneau distribution							7680	60	37	A									Espace	
Espace									39	B									Espace	
Espace									41	C									Espace	
Espace									43	A									Espace	
Espace									45	B									Espace	
Espace									47	C									Espace	
Espace									49	A									Espace	
Espace									51	B									Espace	
Espace									53	C									Espace	
Espace									55	A									Espace	
Espace									57	B									Espace	
Espace									59	C									Espace	
Espace							71080			Neutre									Espace	

Grand total 134 480 Volts-Ampères Total 373 Ampères

APPENDIX D

	STANDARD CONSTRUCTION PRACTICES GENERAL SECTION 2U CUSTOMER/CONTRACTOR	E.D.: 2U
		CUST/CONT
		REVISION: 05
		EFF. DATE: 2008-01-01

AVERAGE DIMENSIONS FOR 100mm CONDUIT AND DUCT (In mm.)			
TYPE	Outside diameter	Inside diameter	Min. wall thickness
RIGID PVC CONDUIT	114.30	102.30	6.00
DB2 PVC DUCT	107.09	100.10	3.05

(Table 2.1)

For conduit systems located on bridges and other special designs, either 100mm (4") rigid PVC conduit or RTRC (Reinforced Thermosetting Resin Conduit) Type AG (Above Ground) conduit shall be used. The latter type is commonly referred to as FRE™ and shall conform to the requirements of CSA C22.2 No. 211.3.

Where underground systems cross under railway tracks, a steel or precast concrete casing pipe will be required.

All further notes in this section (2U) will refer to rigid PVC conduit and DB2 PVC duct since fiberglass duct and concrete or steel casings are utilized sparingly.

2.2 Applications

2.2.1 Primary Cables

Riser Poles:

Rigid PVC 915 mm (36") radius 90° utility elbows shall be used for all horizontal to vertical transitions at riser poles.

Entering Pad mounted Equipment

Rigid PVC 915 mm (36") 90° elbows shall be used for all horizontal to vertical transitions entering pad mounted equipment including transformers and switch enclosures.

Horizontal Ducts:

Type DB2 PVC duct shall be used for all horizontal duct runs. Type DB2 PVC 1525 mm (60") radius bends shall be used for all turns (i.e. 22.5°, 45°, 90°) in horizontal duct runs, including horizontal entry points into cable pits.

2.2.2 Secondary Cables

Note: Secondary Cables refers to NB Power installed and owned conductors up to and including 600 volts (Low Voltage). This does not include the LV conductors from NB Power's last point of connection and the customers premises, generally referred

	STANDARD CONSTRUCTION PRACTICES GENERAL SECTION 2U CUSTOMER/CONTRACTOR	E.D.: 2U
		CUST/CONT
		REVISION: 05
		EFF. DATE: 2008-01-01

to as the customer loop. Customer loops fall under the jurisdiction of the Canadian Electrical Code Part 1, which is enforced by NB Safety Code Services.

Riser Poles:

Rigid PVC 915 mm (36") radius 90° utility elbows shall be used for all horizontal to vertical transitions at riser poles.

Horizontal Ducts:

Type DB2 PVC duct shall be used for all horizontal duct runs. Type DB2 PVC 1525 mm (60") radius bends shall be used for all turns (i.e. 22.5°, 45°, 90°).

Entering Secondary Pedestals

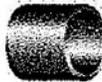
Type DB2 PVC 915 mm (36") radius 45° bends shall be used for entering secondary pedestals.

Entering Padmounted Equipment

Type DB2 PVC 1525mm (60") radius 90° bends shall be used for entering the secondary compartment of padmounted equipment.

2.3 Conduit and Duct Joints, Bends and Terminations

All rigid PVC and DB2 duct fittings, bends, couplers, joints and elbows shall be joined with solvent cement designed for that purpose. "Push-fit only" fittings will not be used. (Fig. 2.3.1)

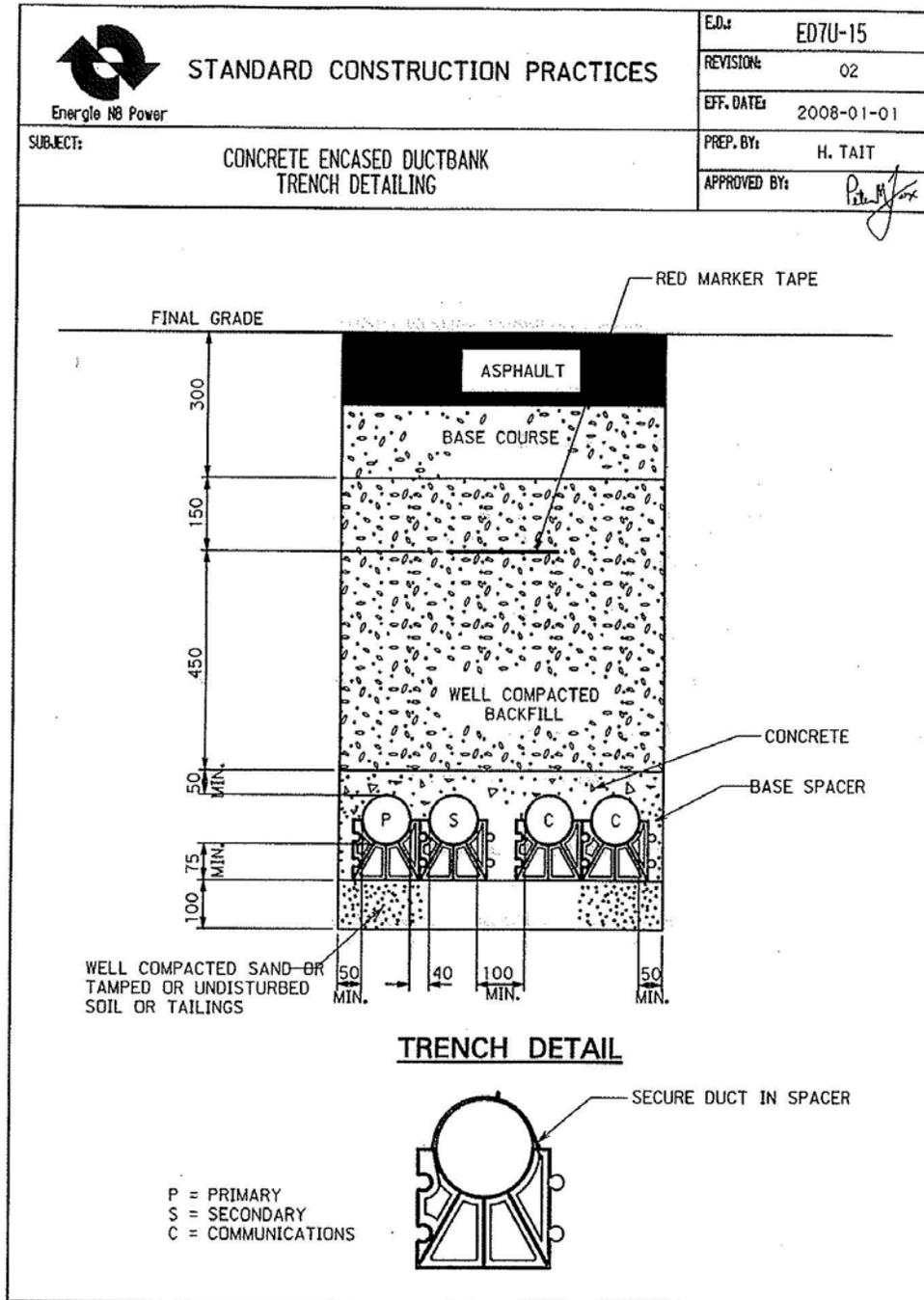


PVC Solvent Weld Coupling (Fig. 2.3.1)

Bends in duct runs may be accomplished by the use of 22.5°, 45° or 90° (Fig. 2.3.2) bends and may be supplemented by the use of 5° couplings (Fig. 2.3.3), although these couplings should be spaced an appropriate distance apart. All bends shall be solvent weld type, not push fit.

ELECTRICITY – SCOPE OF WORK,
DESCRIPTIONS AND LISTS

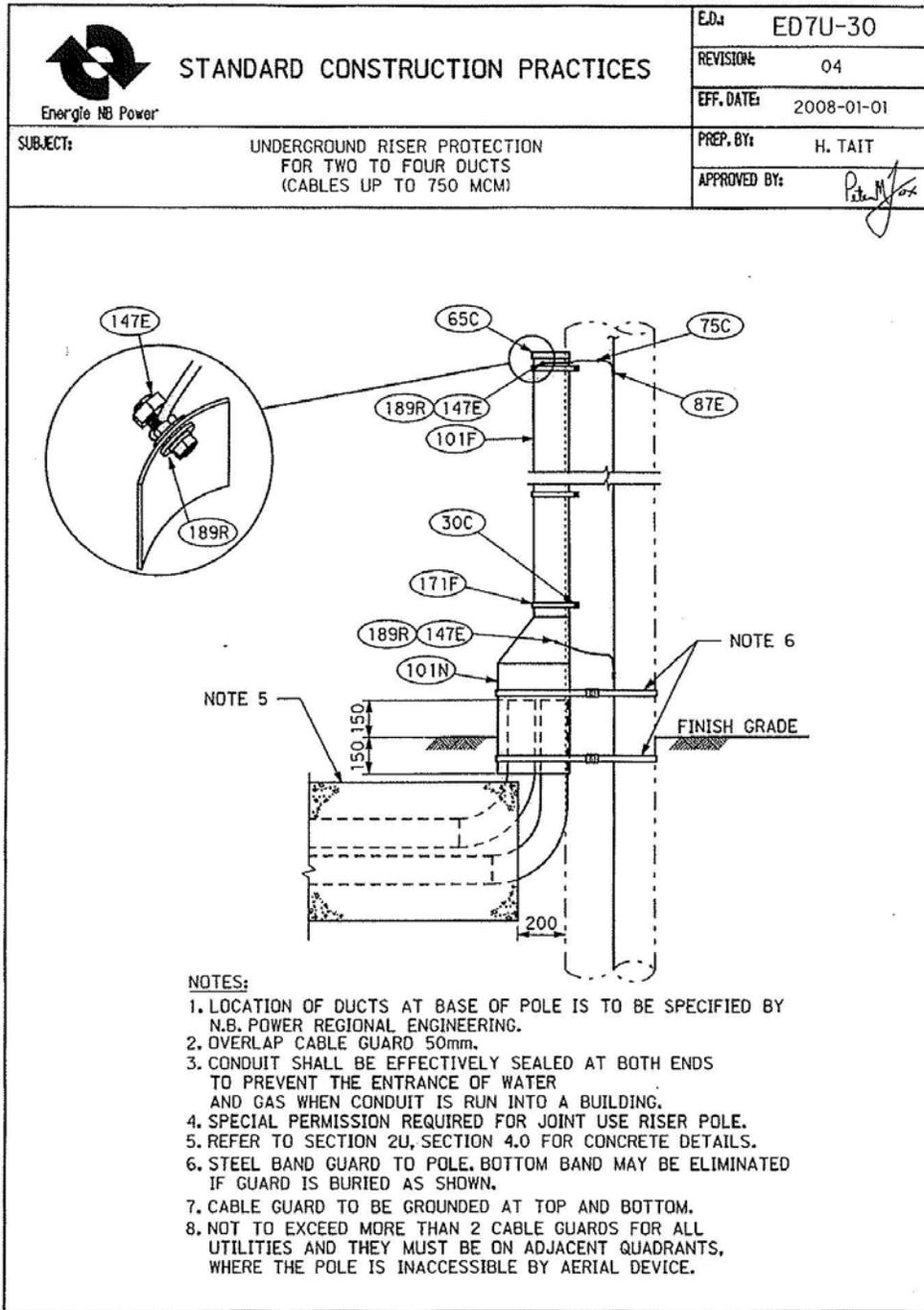
Section 26 05 05



 STANDARD CONSTRUCTION PRACTICES CONCRETE ENCASED DUCTBANK TRENCH DETAILING	E.D.: 7U-15
	REVISION: 02
	EFF. DATE: 2008-01-01

NOTES:

1. Duct as specified in Section 2U, Customer Section.
2. A minimum of 600mm (2 ft.) of well compacted backfill will be installed above the concrete and then covered with road base and asphalt. Local government may require additional backfill above the concrete.
3. Red Marker tape to be installed 450mm (1.5 ft.) below final grade.
4. A fish line of 1/4" nylon rope or equivalent shall be installed in each conduit and rope secured.
5. A minimum of 50mm (2 in.) shall be kept between conduits and forms. A minimum of 100mm (4 in.) shall be kept between NB Power and Communications. Forming of duct bank is essential to maintain constant thickness of concrete.
6. Trench indicates two ducts for communication cable. For specific requirement, contact Aliant and/or CATV.
7. The number and size of ducts may vary. The minimum clearances should be maintained.
8. Ducts should be identified at both ends in a method satisfactory to NB Power.
9. Base spacer shall be placed crosswise in the bottom of the trench at approximately 1.5m intervals.
10. Number of ducts as per Section 2U, Customer section 2.8 and NB Power Regional Engineering.
11. Ducts must be secured in the spacers. The assembly must be kept in place during the concrete pouring process. See section 2U, Customer section 6.0 to 6.8.



	STANDARD CONSTRUCTION PRACTICES FOUNDATIONS SECTION 9U PAD OPTIONS	E.D.: 9U
		PAD OPTIONS
		REVISION: 00
		EFF. DATE: 2008-01-01

PAD OPTIONS

The customer is responsible to provide the padmount transformer pad according to NB Power standards. Those standards currently specify two options for transformer pads:

1. A prefabricated concrete pad, manufactured and delivered to site by an NB Power contractor. Three sizes of pads will be available, SØ (ED 9U-10), 3Ø to 300kva (ED 9U-15) and 3Ø to 1500kva (ED 9U-20).
2. A fiberglass pad meeting NB Power's standard (ED 9U-30) for SØ transformers only, acquired and delivered by the customer.

In both cases, the customer is responsible for all costs associated with the pad, including delivery and installation according to NB Power Standards. However, it must be recognized that the cost of the prefabricated concrete pad (including delivery) will be included in the customer's non-refundable contribution, if the customer chooses the concrete option. If the fiberglass option is chosen, the cost of the pad will **not** be included in the NB Power non-refundable contribution, but is still borne by the customer.

Concrete pads, poured on site, will not be accepted by NB Power for any size of transformer. Also, fiberglass pads will not be accepted for any 3Ø transformer, only for SØ transformers. These changes have been implemented as a result of quality problems resulting in drastically increased maintenance costs for NB Power.

Pour livraison, communiquez avec
White's Precast Concrete Ltd.

Peter White ou Dennis Murphy
Tél. local (506) 276-4548
Sans frais 1-800-222-9536
Fax (506) 276-4857
Courriel: Wpc1995@nb.aibn.com

For Delivery Contact
White's Precast Concrete Ltd.

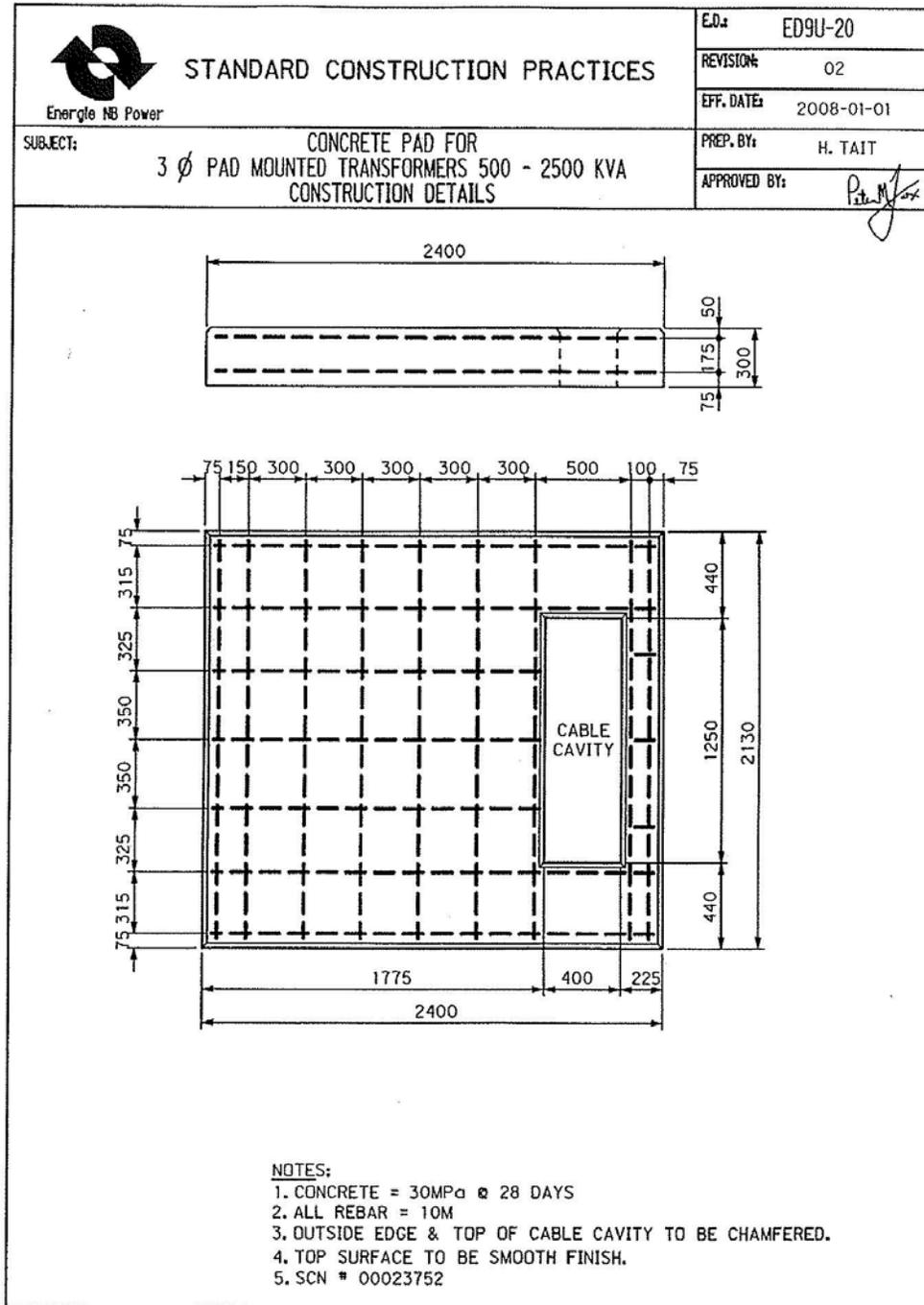
Peter White or Dennis Murphy
Phone Local (506) 276-4548
Toll Free 1-800-222-9536
Fax (506) 276-4857
E-Mail: Wpc1995@nb.aibn.com

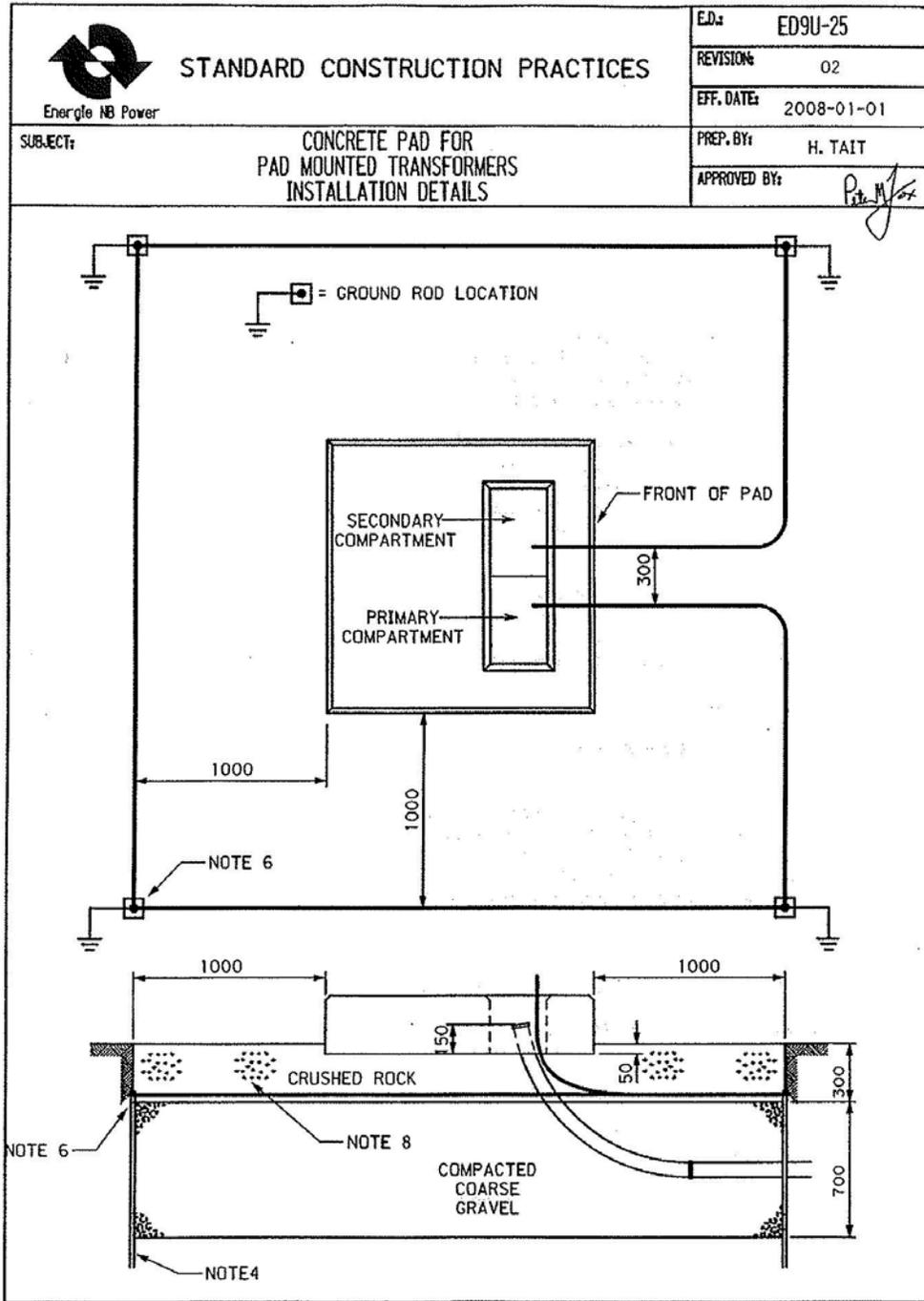
Work Order ID _____
Commande de travail

ED9U-10 ED9U-15 ED9U-20

ELECTRICITY – SCOPE OF WORK,
DESCRIPTIONS AND LISTS

Section 26 05 05





 STANDARD CONSTRUCTION PRACTICES CONCRETE PAD FOR PADMOUNTED TRANSFORMERS INSTALLATION DETAILS	E.D.: 9U-25
	REVISION: 02
	EFF. DATE: 2008-01-01

NOTES:

- A. The customer shall supply and install all labour and materials associated with the installation of the transformer pad, including ducts (both primary and secondary), fill and grounding components. The minimum size, number and layout of secondary ducts shall be adequate for the customer needs. All details associated with the primary ducts shall be according to Section 2U of these standards. NB Power will provide additional details as required. The customer shall also install, own and maintain the low voltage underground service loop conductors from the secondary terminals of the supply transformer to the service entrance.
- B. The transformer pad will be prefabricated under contract from NB Power. NB Power will provide the customer with the contact details so as to make arrangements for delivery of the pad. The customer will be billed for this service as part of the non-refundable contribution required for underground service. The customer will be required to ensure that the pad is installed level on a properly prepared surface.
- C. The location shall meet all NB Power Standards as outlined in Section 3U with an emphasis on clearances to buildings. The front of pad to be at least 3m away from buildings or other objects to permit operational access. A clearance of 1 metre shall be maintained between the transformer and any other objects in addition to the above requirements.

The Customer Shall:

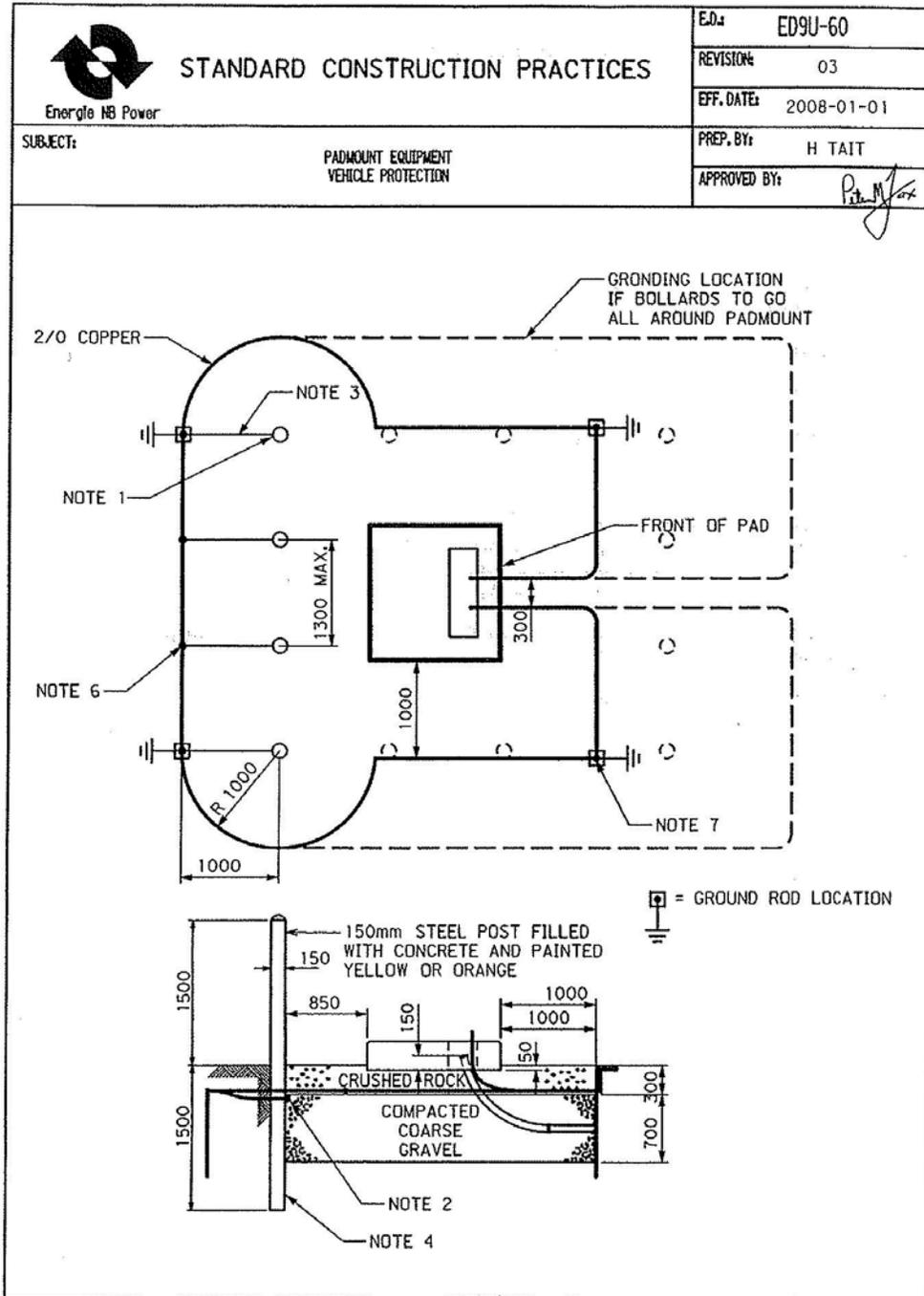
1. Excavate an area equal to the size of the pad plus 1m on all sides and to a depth of 1m deep.
2. Install all ducts and ensure they are fished, capped and identified as to where they terminate. A template sized according to the cable cavity as shown in the appropriate Construction Drawing (ED 9U-10, 9U-15 or 9U-20) should be utilized to ensure that the ducts will not obstruct the installation of the prefabricated pad. Note the location of the primary and secondary ducts on the Drawing 9U-25.
3. If specified by NB Power, protection from vehicles shall be installed as per ED9U-60.
4. Install four 3/4" x 3m ground rods located as shown on drawing.
5. Backfill the excavation to within 300 mm of final grade with well compacted coarse gravel.
6. Install a loop of 2/0 bare copper as shown, connected to the four ground rods with ground rod clamps (reference NB Power SCN 7212303Q), U-bolt connectors or other connectors approved by the manufacturer for this application. 1.0m of 2/0 copper (above final grade) shall be left on each end of the grounding loop in the cable cavity to allow for connection to the NB Power transformer ground bus.
7. Install the prefabricated transformer pad and ensure that it is level.

 STANDARD CONSTRUCTION PRACTICES CONCRETE PAD FOR PADMOUNTED TRANSFORMERS INSTALLATION DETAILS	E.D.: 9U-25
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8. Backfill the excavation to final grade with crushed rock 3/4 to 3/8" grade.
9. If specified by NB Power, protection from vehicles shall be installed as per ED9U-60.

ELECTRICITY – SCOPE OF WORK,
DESCRIPTIONS AND LISTS

Section 26 05 05



 STANDARD CONSTRUCTION PRACTICES	E.D.: 9U-60
	REVISION: 03
	EFF. DATE: 2008-01-01
PADMOUNT EQUIPMENT VEHICLE PROTECTION	

NOTES:

1. Vehicle protection is required on those sides of the padmount subject to vehicle damage as specified by NB Power.
2. Install a ground connector 1200 mm from the bottom of each steel pipe.
3. Install a 2/0 copper conductor from the padmount ground loop to the posts.
4. Steel pipe to be schedule 40 thickness.
5. **(DELETED)**
6. Connection to be made with a connector which is suitable for direct buried copper conductors. For example copper crimps (reference NB Power SCN 7211314X), Cadweld, bronze service post connectors, wedge type connectors (reference NB Power SCN 7211545X) or other connectors approved by the manufacturer for this application.
7. Use ground rod clamp (reference NB Power SCN 7212303Q), U-bolt ground clamp or other connectors approved by the manufacturer for this application.
8. Refer to Section 3U for Clearances

PART 1 – GENERAL

1.1 WORK IN EXISTING
BUILDING

.1 General:

- .1 The contractor will have to visit the site in order to see the scope of work to be done in the building. He will have to verify the type of construction in order to predict difficulties that could be encountered during construction, because of walls, beams, conduits, wires, pipes, etc., which are already in place and/or are planned in drawings.
- .2 No allowance will be granted, because of failure by the contractor to perform all the required verifications.
- .3 No allowance will be granted for research, identification and other works related to the existing power supply circuits (equipment, junction box, panels, others).
- .4 The contractor is responsible for the removal of all existing electric devices not reused: conduits, conductors, boxes, disconnect switches, panels. Costs for these works will be included in the bid.

1.2 OTHER
SPECIALITIES

- .1 The contractor will carefully consult drawings of other specialties before presenting its bid in order to see the modifications to the existing building and to coordinate its works.

1.3 UNUSED
WIRING

- .1 When existing conduits and fittings are no used after modifications, they will have to be completely removed with connection wiring up to the original switchboard panel.

1.4 OBSTACLES

- .1 All moving and bypasses of obstacles will be executed by the contractor.

1.5 DEMOLITION
WORKS

- .1 Unless otherwise specified, all wirings and dismantled conduits cannot be reused on site. Following demolition works will have to be performed by the contractor.
- .1 Refer to drawing E-2/4, Plan View – Existing, to know the scope of work.
 - .2 Unless otherwise specified by the owner, all material, conduits, devices and equipment coming from demolition works will remain the property of the owner and the contractor will have to dispose of them in an area specified by the owner.
 - .3 For all other material, conduits and accessories and for those not kept by the owner during demolition works, the contractor will have to

dispose of them off-site. The contractor will have to respect all environmental standards and provide the owner disposal certificates.

1.6 COORDINATION OF
NEW WORKS WITH
THE EXISTING
INSTALLATION

- .1 Move any material and equipment of the various existing systems within its specialty that obstruct the passage or the execution of his work and those of all other specialties.
- .2 The contractor is responsible to verify on-site according to works to be performed and to coordinate with the other work specialties.
- .3 Include required costs for these displacements in the bid.
- .4 When works will take place in sections and/or close to existing buildings, the contractor will have to provide, install and connect wirings and conduits to provide continuous electrical service to buildings not directly affected by these works.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.2 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with the Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Department's Designated Representative

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors with copper current carrying elements of proper caliber to fit copper conductors as required.
- .2 Fixture type splicing connectors with current copper carrying elements of proper caliber to fit copper conductors 10 AWG or less.

- .3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
 - .1 Connector body and stud clamp for stranded copper.
 - .2 Clamp for stranded copper conductors.
 - .3 Clamp for aluminum conductor steel-reinforced conductors (ACSR).
 - .4 Stud clamp bolts.
 - .5 Bolts for copper conductors or bus bar.
 - .6 Bolts for aluminum conductors or bus bar.
 - .7 Sized for conductors and bars as indicated.
- .4 Clamps or connectors for armored cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.
- .5 Waterproof connectors for Teck cables.
- .6 All connectors and clamps are to be of brand name Thomas & Betts or Burndy.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install connectors for bus bar connections per manufacturer's recommendations.
- .2 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet safety tests in accordance with CSA C22.2 No.65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2 and NEMA standards.
 - .5 The contractor will have to prove that each screw has been tightened to manufacturer's requirements.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 This section deals with copper conductors, ACM alloy aluminum conductors designed for rated voltages from 0 to 1000 volts, and the most current ducts and electrical insulation types.
- 1.2 REFERENCES .1 Electrical Canadian Codes, part 1.
.2 CSA C22.2 No. 0.3, Test Methods For Electrical Wires and Cables
- 1.3 PRODUCT DATA .1 Provide product data in accordance with Section 01 33 00 Submittal Procedures. Documents and samples 26 05 00 general requirements.
.2 Perform dielectric tests in accordance with Section 26 05 00 – Common work results for electrical.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 BUILDING WIRES .1 When cables must have a PVC overall jacket, they must pass the required test for vertical fire according to CSA Standard C22.2 no. 0.3 as per National Building code Specifications building class and depending on where the cables will be installed.
.2 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
.3 Copper conductors: size as indicated, with 600 or 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE.
.4 Use 1000 V insulated cable for motor supplied from variable

frequency drive.

- .5 Insulated green conductor of minimum 12 AWG is required for all conduits other than treated galvanized rigid steel for mass continuity (see section 26 05 34 – conduits, conduit fastenings and conduit fittings)
- .6 Neutral supported cable: 1, 2, 3 phase insulated conductors of Copper or Aluminum and one neutral conductor of Copper or Aluminum steel reinforced, size as indicated. Type: NS75 or NS90. Insulation: Type NS-1 rated 300 V and Type NSF-2 flame retardant rated 600 V.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .1 Grounding conductor: copper
 - .2 Circuit conductors: copper, sized as indicated.
 - .3 Teck cables will have cross-linked polyethylene insulation (XLPE). They will be insulated to 600 V for use up to 300 V and will be insulated to 1000 V for use up to 600 V. They will be provided with a polyvinyl chloride and metallic armor aluminum foil sheath.
 - .4 Teck cables for control and communication uses not exceeding 300V will be insulated at 600V and will have a metallic armor with stainless steel liners. Conductors will be in copper size 12 minimum, considering loads, voltage drops and the number of conductors per cable.
 - .5 All Teck cables will be of type 90 with a polyvinyl chloride (PVC) outer jacket. They will be in compliance with standard CAN/CSA-C22.2 No. 131 and 174 for their hazardous locations (HL) and against the flame propagation (FT-4).
 - .6 Fastenings:
 - .1 One hole steel strap to secure surface cable 50mm and smaller. Two hole steel straps for cables larger than 50mm.
 - .2 Channel type supports for two or more cables at 1,5 m maximum spacing.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.7 Connectors:

.1 Watertight or explosion-proof approved for TECK cable.

2.3 ARMORED CABLES

.1 Conductors: insulated copper sized as indicated.

.2 Type: AC90.

.3 Metallic armor: aluminum strip.

.4 Type: ACWU90 with PVC jacket over fireproof armor and compliant to applicable Building Code classification for this project for cables installed in wet locations.

.5 Connectors: anti-short-circuit connectors.

2.4 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, sized as indicated.

.2 Insulation: cross linked polyethylene (XLPE), typeRA90, rated 600V or 1000 V.

.3 Sheath: aluminum applied to form continuous corrugated and waterproof to liquid and vapor tight.

.4 Outer envelope (required where the cables are directly buried, installed in damp or corrosive environments): thermoplastic (PVC) resistant to flame propagation (CFT-4) and sunlight (SUN RES).

.5 Fastenings for aluminum sheathed cable:

.1 One hole aluminum or malleable iron straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm.

Use access plates, fittings, bushings, washers and cable ties with non-ferrous mono-drivers carrying more than 200A.

.2 Channel type supports for two or more cables at 1 m centers.

.3 Threaded rods: 6 mm diameter to support suspended

channels.

- 2.5 CONTROL CABLES
- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated. Insulation: thermoplastic. Sheath: thermoplastic jacket and armor of closely wound aluminum wire.
 - .1 Type: low energy 300 V control cable: solid or stranded annealed copper conductors sized as indicated LVT.

Insulation: PVC type TW or TWH. Overall covering in PVC jackets.
 - .2 Type: 600 V stranded annealed copper conductors, sizes as indicated: insulation in PVC type TW, TWH, RW90 (x-link), overall covering in PVC. All these cables shall pass by conduits in compliance with section 26 05 34 – Conduits, conduit fastenings and conduit fittings.

- 2.6 WIRE EXPOSED TO SUN RAYS
- .1 The insulated electrical wires and cables directly exposed to the sun rays must be approved specifically for that use and indicated in consequence.

- 2.7 ACM CONDUCTORS
- .1 The use of aluminum alloy conductors ACM is accepted for 200A and more feeders only for projects where the wiring is in rigid steel conduit or PVC. It is the responsibility of the contractor to calculate the conduit diameter to meet the filling prescribed by the Canadian Electricity Code, Part one.

PART 3 - EXECUTION

- 3.1 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Perform tests using the appropriate methods to site conditions and local authority having jurisdiction over installation.
 - .3 Perform tests before energizing electrical system.
- 3.2 GENERAL CABLE INSTALLATION
- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
 - .2 Cable Color Coding: to Section 26 05 00 Common Work Results

for Electrical.

- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centers, pull boxes, and termination points.
- .5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Unless otherwise stated, all wiring must be in conduit
- .2 Use conduit types or duct as per respective sections.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable as indicated, securely supported by staples, straps and hangers.
- .3 Terminate cables in accordance with Section 26 05 20 – Wire and Box connectors -0-1000V
- .4 Unless otherwise stated, no TECK 90 cables installation are permitted.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 In the drop ceiling and drywall, the contractor may use armored cables AC-90 between fixtures so that the length of the cable used between two fixtures or the junction boxes and a fixture does not exceed 3000 mm.
- .2 In drop ceilings and drywall, the contractor may use armored cables AC-90 between electrical outlets on the same circuits so that the length of the cable used between two outlets or between the junction box and an outlet does not exceed 6000 mm.
- .3 Make groups of three cables maximum everywhere when possible and supported at every 1.5 meters. The cables must follow the structural lines of the building. No horizontal cables in the partitions will be accepted.

- .4 Exposed surface mount armored cable AC-90 will not be permitted.
- .5 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors -0 - 1000V.

3.6 INSTALLATION OF ALUMINUM SHEATH CABLES

- .1 Whenever possible, group cables with “U” support.
- .2 Support at every 1.5 meters. The cables must follow the structural lines of the building. No horizontal cables in the partitions will be accepted.

3.7 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit as per instructions.
- .2 Ground control cable shield.

3.8 INSTALLATION OF NON-METALLIC SHEATHED CABLE

- .1 NMD90 cable is normally used only in frame construction especially residential.
 - .1 Install cables as indicated.
 - .2 Install straps and box connectors to cables as required.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-[1989(R1996)], Qualifying Permanent Connections Used in Substation Grounding.
 - .2 Canadian Standards Association, (CSA International)
 - .3 CSA C22.2 no41 – Grounding and bonding equipment.
 - .4 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities.
- 1.2 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
 - .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in accordance with Waste Management Plan.
 - .4 Divert unused metal materials from landfill to metal recycling facility as approved by the Department's Designated Representative.
 - .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT
- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
 - .2 Rod electrodes: copper clad steel 19 mm dia by 3 m long (minimum of 3 per site).

- .3 Grounding conductors: bare stranded copper, annealed, sized as indicated.
- .4 Insulated grounding conductors: green, type RWU-90 in soil or damp areas and type RW-90 in all other areas, sized as indicated.
- .5 Ground bus: copper, sized as indicated, complete with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Aluminothermic welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Splicing wire connectors
 - .7 Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes (minimum 3 per site), conductors, connectors, required accessories according to specifications, in order to satisfy requirements and local authorities.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical damages.
- .4 Make buried connections, and connections to conductive water main, electrodes, using approved compression connectors or welded by aluminothermic process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted unless it completes the installation of a compression joint.
- .7 Install bonding wire for flexible conduit, connected at both to grounding bushing, solderless lug, clamp or cup washer and screw.

- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Make grounding connections in radial configuration only, with connections terminating at single grounding point, street side of water pipe. Avoid loop connections.
- .10 Bond single conductor, metallic armored cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .11 Ground secondary service pedestals.

3.2 MANHOLES

- .1 Install conveniently located grounding stud and electrode in stranded copper conductor in each manhole.
- .2 Install ground rod in each manhole so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.

3.3 ELECTRODES

- .1 Install rods and make grounding connections according to specifications.
- .2 Link together the independent electrodes
- .3 Use copper conductors of adequate size as specified for the linking of electrodes.
- .4 Take necessary measures for the installation of electrodes in order to obtain a value of earth resistance complying with the requirements of the electricity distributor and the National Building Code. Make connections in compliance with the specifications.
- .5 Install a bottom less fiber junction box to simplify the location in soil. The box shall exceed of 150mm, the finished ground level.

3.4 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary 347/600 V system, secondary 120/208 V system.

3.5 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, duct systems, frames of motors, starters, control panels, distribution panels, outdoor lighting, etc.

3.6 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Connect the equipment of the local electrical installation of the grounding bus bar, using individual conductors in bare and stranded copper, and of size as indicated.

3.7 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Department's Designated Representative and local authority having jurisdiction over installation. Tests shall be performed by a specialized firm and duly signed by an engineer.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

PART 1 - GENERAL

1.1 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by the Department's Designated Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT
CHANNELS

- .1 U-shaped brackets, hot galvanized steel, 41 mm x 41 mm minimum dimension, 2.5 mm minimum thickness, laid on the surface, suspended or embedded in concrete poured ceilings and walls.
- .2 Installation accessories such as threaded rods, bolts, washers, nuts, spring nuts, etc., in plated steel or chrome or zinc.
- .3 Galvanization products complying with standard CAN/CSA-G164.
- .4 Fastenings used outside and in humid areas shall be in galvanized steel.
- .5 Fastenings, supports and installation accessories shall be in accordance with section 26 10 00 - Earthquake-resistant fixations.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Refer to Section 01 61 00 - Common Product Requirements for fastenings and supports.
- .2 Secure equipment to hollow or solid masonry surfaces with lead anchors or nylon shields.
- .3 Secure equipment to poured concrete with expandable inserts.
- .4 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed for U shape accessories.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits, use channels at 1 m on centre spacing.
- .9 Ensure adequate supports for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Department's Designated Representative.

- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Cover with galvanizing product scratched, damaged or cut surfaces of galvanized parts.

PARTIE 1 – GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association. (CSA) / CSA International
- .1 CSA C22.1-F06, Canadian code of Electricity, Part 1, Current edition.
 - .2 CSA C22.2 number 76 – Distribution box.
 - .3 CSA C22.2 number 40.
- 1.2 SUBMITTALS .1 Submit all documents and samples required in accordance with sections 01 33 00 – Submittal Procedures and 26 05 00 – Common Work Results for Electrical.
- .2 Product Data :
- .1 Submit required data sheets, specifications, and manufacturer's literature on product coverage. These records must indicate the product specifications, performance criteria, dimensions, limits, and finishes.
 - .3 Submit shop drawings required in accordance with Section 26 05 00 – Common work results for electrical.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Waste Management and Disposal
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- 1.4 ELECTRICAL APPLIANCES PROTECTED BY SPRINKLERS .1 Install and supply all material in accordance with Section 26 05 00 – Common work results for electrical.

PARTIE 2 – PRODUCTS

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs connection blocks to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND
PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around, adjustable to pull and junction boxes.
- .3 Covers Surface Mounted: 150 x 150 barring hinge.

2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T Terminal: Sheet steel, hinged door, latch, lock, 2 keys, containing 19 mm sheet steel backboard for flush mounting
- .3 Transformer cabinet: Sheet steel, for surface mount or flush mounting, latch, padlocking device, standard cable knockout, removable back panel, as indicated.

2.4 CONNECTORS

- .1 Metallic sleeves and connectors with Nylon insulation for size no. 8AWG and smaller.
- .2 Pressure disk to prevent fragments from entering knockout.
- .3 Conduit coupling with access for conduit up to 35 mm diameter and pull boxes for conduits of bigger dimensions.
- .4 Inside and outside lock-nut with insulated metallic sleeves for metal boxes

PART 3 - EXECUTION

- 3.1 SPLITTER INSTALLATION
- .1 Mount plumb, true and square to building lines.
 - .2 Extend splitters full length of equipment arrangement except where indicated otherwise.
- 3.2 JUNCTION,PULL,BOXES AND CABINETS INSTALLATION
- .1 Install pull boxes in inconspicuous but accessible locations.
 - .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
 - .3 Install terminal block as indicated in Type T cabinets.
 - .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1. There should be no more than 30 m in length between and 4 bends of 90 degrees.
 - .5 Supply screw type terminal blocks in junction box with 4 wire connection and more.
- 3.3 IDENTIFICATION
- .1 Equipment Identification: Section 26 05 00 - Common Work Results for Electrical.
 - .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, latest Edition.
 - .2 CSA C22.2, no.18, outlet boxes, and accessories
- 1.2 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and section 26 05 00 – Common Work Results for Electrical.
 - .2 Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures and section 26 05 00 – Common Work Results for Electrical.
- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 OUTLET AND CONDUIT BOXES GENERAL
- .1 Size boxes in accordance with CSA C22.1. (First Part)
 - .2 102 mm square or larger outlet boxes as required.
 - .3 Gang boxes where wiring devices are grouped.
 - .4 Blank cover plates for boxes without wiring devices.
 - .5 347 V outlet boxes for 347 V switching devices.
 - .6 Combination boxes with barriers where outlets for more than one system are grouped.
- 2.2 GALVANIZED
- .1 Single and multi gang flush device boxes for flush installation,

STEEL OUTLET BOXES

minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

- .2 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 OUTLET BOXES
FOR NON-METALLIC
SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS -
GENERAL

- 1 Insulated metal sleeves and connectors with nylon insulation size No. 8 AWG and larger.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.

- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 Provide correct size of openings in boxes for conduit, mineral insulated and armored cable connections. Do not install reducing washers.
- .4 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .5 Identify systems for outlet boxes as required.

PART 1 - GENERAL

- 1.1 CONDUITS LOCATION .1 Conduits are not all indicated on drawings. Those appearing are represented schematically.
- 1.2 EARTHQUAKE-RESISTANT FIXATIONS .1 Supply and install all necessary material for earthquake-resistant fixations as specified in Section 26 10 00 – Earthquake-resistant fixations.
- 1.3 REFERENCES .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).
- .2 Canadian Electrical Code Handbook, Part 1.
- 1.4 SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and 26 05 00 – Common work results for electrical.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
- .3 Quality assurance submittals:
- .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance criteria and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
- 1.5 WASTE .1 Separate waste materials for reuse and recycling in accordance

MANAGEMENT AND
DISPOSAL

with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized and threaded steel.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with sealed couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 FRE conduit: CSA C22.2.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.

Two hole steel straps for conduits larger than 50 mm.

When attached outside and in humid areas, straps shall be in galvanized steel.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 2 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.
- .5 Quantities and dimensions mentioned previously for various straps are a minimum and shall respect specifications in the section on earthquake-resistant fixations.

2.3 CONDUIT
FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18 manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "L" fittings where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.
- .4 Ring for conduits in boxes, when required by the Canadian Electrical Code Handbook, Part 1, of metallic type only and nylon insulated.

2.4 EXPANSION
FITTINGS FOR RIGID
CONDUIT

- .1 Provide expansion fittings necessary for all conduits:
 - Embedded in concrete and crossing expansion joints of building
 - Apparent and subjected significant temperature changes
 - Whose length exceeds limits allowed by the manufacturer
- .2 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .3 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .4 Weatherproof expansion fittings for linear expansion at entry of panels.

2.5 FISH CORD

- .1 Fish cord of 6mm in polypropylene

2.6 MASS CONTINUITY

- .1 In all conduits other than those in 2.1.1, an isolated GREEN conductor of minimum size of 12 AWG shall be installed.

2.7 CONDUITS EXPOSED
TO SUNLIGHT

- .1 Non-metallic piping completely closed directly exposed to sunlight shall be approved specifically for this use and be marked consequentially.

PART 3 - EXECUTION

3.1 MANUFACTURER'S
INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.
- .3 Use electrical metallic tubing (EMT) with sealed connections.
- .4 Use rigid PVC conduit underground or embedded in concrete.
- .5 Use rigid galvanized steel threaded conduit in areas classified explosion-proof or in humid areas.
- .6 Use epoxy coated conduit in corrosive areas.
- .7 Use flexible metal conduit of maximum length of 3m for connection to motors or vibrating equipment in dry areas or connection to recessed incandescent fixtures.
- .8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .9 Install explosion-proof and liquid tight fittings in hazardous areas
Fill them with epoxy paste.
- .10 Bend conduit cold: Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11 Mechanically bend steel conduit over 21 mm diameter.
- .12 Use conduits of at least 21mm for lighting and power circuits.
- .13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .14 Install fish cord in empty conduits.
- .15 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.3 SURFACE
CONDUITS

- .1 Unless otherwise specified by an explicit note on drawings, install conduits parallel or perpendicular to building lines.
- .2 Run conduits in flanged portion of structural steel.
- .3 Group conduits wherever possible on suspended or surface channels.
- .4 Do not pass conduits through structural members except unless otherwise specified.
- .5 Install expansion joints on PVC conduits when they are installed in areas where the temperature varies of more than 10 degrees. There must be an expansion joint for each length of 7.5m and 15m maximum between each joint.

3.4 CONDUITS IN
CAST-IN-PLACE
CONCRETE

- .1 Do not place any conduits in concrete unless indicated in specifications and drawings.
- .2 Install in centre one third of slab and locate to suit reinforcing steel.
- .3 Protect conduits from damage where they stub out of concrete.
- .4 Install sleeves in areas where conduits pass through slabs or walls.
- .5 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .6 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .7 Organize conduits in slab to minimize cross-overs.
- .8 It is prohibited to embed aluminum conduits in concrete.

3.5 CONDUITS
UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints with heavy coat of bituminous paint.

- .3 Install conduits at 1m from the surface or according to specifications
- .4 Underground conduits shall be in rigid PVC with minimum diameter of 41mm.
- .5 Underground conduits shall be surrounded with a fine sand layer of 150mm unless otherwise specified.

PART 1 - GENERAL

- | | | |
|--|----|--|
| <u>1.1 REFERENCES</u> | .1 | Canadian Standards Association, (CSA International) |
| | .2 | Insulated Cable Engineers Association, Inc. (ICEA) |
| <u>1.2 WASTE
MANAGEMENT AND
DISPOSAL</u> | .1 | Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal. |
| | .2 | Remove from site and dispose of all packaging materials at appropriate recycling facilities. |
| | .3 | Collect and separate for disposal paper, plastic polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan. |
| | .4 | Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard. |
| | .5 | Divert unused metal and wiring materials from landfill to metal recycling facility as approved by the Department's Designated Representative . |
| | .6 | Do not dispose of preservative treated wood through incineration. |
| | .7 | Do not dispose of preservative treated wood with other materials destined for recycling or reuse. |
| | .8 | Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by the Department's Designated Representative. |
| | .9 | Fold up metal banding, flatten and place in designated area for recycling. |

PART 2 - PRODUCTS

- | | | |
|-----------|----|---|
| 2.1 CABLE | .1 | 38 x 140 mm planks pressure treated with clear colored or |
|-----------|----|---|

PROTECTION

- copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
- .2 Plastic preventive ribbon marked by ***Danger Electricity***

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Cedar post type markers: 89 x 89 mm by 1.5 m long, pressure treated with clear or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.
 - .1 Nameplate: aluminum anodized 89 x 125 mm and 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

PART 3 - EXECUTION

3.1 CABLE
INSTALLATION IN
DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of color coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.2 MARKERS

- .1 Mark cable every 150 m along cable or duct runs and changes in

direction.

.2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.3 Lay concrete markers flat and centered over cable with top flush with finish grade.

3.3 FIELD QUALITY
CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 For three-phased circuits, verify and establish a phase sequence A-B-C, left to right, bottom to top, front to back and retain it for all installation with the exception of devices electrically linked.

.4 Check and repair each phase rotation and identify conductor of each feeder.

.5 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.6 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.7 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armor and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing at original factory test

voltage in accordance with manufacturer's recommendations.

- .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
- .8 Provide Department's Designated Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .9 Remove and replace entire length of cable if cable fails to meet any of test criteria.

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND
PRODUCTS CHARACTERISTICS

- .1 Submit shop drawings and products characteristics according to section 01 33 00- Submittal procedures and 26 05 00 – Common work results for electrical.

PART 2 - PRODUCTS

2.1 Photoelectric
Lighting Control

- .1 Wall mounting or unless otherwise specified.
- .2 Capable of switching 2000 W of lighting at 120 V.
- .3 Voltage variation: plus or minus 10%.
- .4 Temperature range: minus 40 °C to plus 70 °C.
- .5 Switching on lights at 20 lx.
- .6 Switching off lights at 500 lx.
- .7 Warranty of 5 years.
- .8 2 minutes delay initiation
- .9 Mounting adaptor of ½"
- .10 Color coded leads: 10 AWG and length of 460mm.
- .11 Switching time delay of 30 s.
- .12 Accepted product: Tork Control no 2101 or equivalent.

2.2 Contactor

- .1 Cabinet and Pole mounting.
- .2 Capability of switching multiple lamp circuits with total lighting load of 2000 W.
- .3 Waterproof enclosure.
- .4 Manual override.

PART 3 - EXECUTION

- 3.1 Installation .1 Install photoelectric controls in accordance with manufacturer's instructions.

PART 1 – GENERAL

- 1.1 References
- .1 Seismic protection measures must meet the requirements of National Building Code.
 - .2 The design must conform to the following documents:
 - SMACNA, Seismic Restraint Manual Guidelines for Mechanical Systems.
 - ANSI/NFPA 13, Installation of Sprinkler Systems
 - National Building Code
 - Seismic Data project area.
- 1.2 Work Scope
- .1 Design, supply and install a complete system of seismically insulated fasteners against vibration or non-insulated as required for electrical equipment and related systems.
 - .2 The design should be done by an engineer member of the Order of Engineers and earthquake specialist system and must bear the seal and signature of the Department's Designated Representative.
 - .3 The seismic system of fasteners must be fully integrated and compatible with the requirements for reducing noise and vibration control system for electrical equipment and related systems as specified on the drawings and elsewhere.
 - .4 The seismic system of fasteners must be compatible with the electrical design and the design of the building structure.
 - .5 During or after the earthquake, the fixed material does not necessarily remain in working order as in normal conditions of use. The mandatory requirements are that the system prevents attachments seismic systems and electrical equipment to cause injury to persons.
 - .6 Provide and install the following equipment:
 - Anti-vibration with seismic dampers.
 - Seismic Dampers.
 - Fixing of slack cables.
 - Any other equipment necessary for a complete assembly.

-
- 1.3 Shop Drawings
- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results for Electrical.
 - .2 Provide shop drawings and data sheets for each of the separate systems and devices for seismic mounting hardware.
 - .3 Shop drawings should clearly define the technical implementation and calculations showing the forces applied to the anchors. These documents must be sealed by an engineer specializing in earthquake-resistant fasteners and a member in good standing of the Order of Engineers.
- 1.4 Construction drawings
- .1 Once construction is complete, the Contractor shall give the Department's Designated Representative a complete set of original construction documents, revised to take into account the conditions of the system as built.
 - .2 Submit documentation detailing the installation procedures for seismic fastening systems.

PART 2 – PRODUCTS

- 2.1 General
- .1 The size and shape of the bases and the performance characteristics of vibration devices must conform to manufacturer's recommendations and instructions.
 - .2 Fabrication and installation of protection devices against earthquakes in accordance with the National Building Code.
 - .3 Seismic protection systems must be able to resist forces in all directions.
 - .4 The binding and attachment points must withstand the same loads as seismic protection devices.
 - .5 Fasteners installed seismic networks of pipes; rods and shelves sheathed cables shall be compatible with the requirements for anchoring and guiding such networks.
 - .6 Mechanical expansion anchors of resistance should be used for seismic protection for concrete structures.

The use of anchors and fasteners bay nail gun or in holes drilled for this purpose is prohibited.

.1 Acceptable Products: Hilti HSL type.

.7 The use of cast iron supports or made of threaded pipe or other brittle materials is prohibited.

.8 Protective devices installed seismic on networks of conduits, bus ducts, cable racks and other related fasteners attached to the equipment must be compatible with the vibration and seismic devices for the component.

.9 The seismic protection devices must not interfere with the operation of firewalls or compromising integrity.

.10 The whole system of seismic fasteners must be provided by a single manufacturer and supplier.

.11 Suppliers Acceptable Korfund Dynamics, Vibro-Acoustics, Noise Kinectics conrol, Tecoustics, Vibra-Sonic controls.

2.2 Fixings for seismic static material
(Equipment not requiring anti-vibration mountings)

.1 Equipment installed on the floor:

.1 Attach the hardware to the support, which must be attached to the frame, using the sizes of bolts indicated on the shop drawings of these systems.

.2 Suspended equipment, including networks of electrical conduits, bus ducts, cable racks and other similar systems associated:

.1 Use one or more of the following methods, depending on site conditions:

.1 Attach securely to the frame material.

.2 Strengthening the material in all directions.

.3 Accentuating the mounting hardware to the frame.

.4 Secure the material with slack cables.

.2 The fixing of conduit systems, bus ducts, and cable racks with cables relaxed prevents wobble in the horizontal plane, the swing in the vertical plane and the sliding and buckling in the axial direction.

- .3 Precautions must be taken to ensure that the hanger rods can withstand the compression load and does not buckle.
- .4 The system must perform a seismic damping smooth and regular, due to an elastomeric material or other means, to prevent high impact loads.

2.3 FIXATIONS PARASISMIQUES POUR LE MATÉRIEL ISOLÉ CONTRE LES VIBRATIONS

- .1 Equipment installed on the ground:
 - .1 Apply one or more of the following methods, depending on the site conditions:
 - .1 Use anti-vibration devices with integrated damping system.
 - .2 Use separate dampers plus anti-vibration devices.
 - .3 Use a cushioning system made up of structural elements and an elastomeric layer, with the approval of an engineer.
 - .2 Seismic devices should in no way affect the action of acoustic and vibration systems. Provide a clearance of 4 to 8 mm, in normal operation of equipment and systems, shock absorbers between the seismic protection devices and equipment.
 - .3 Incorporate seismic protection devices for anti-vibration systems to prevent their complete discharge.
 - .4 The damping effect exercised, due to an elastomeric material or other means, should be smooth and even to prevent high impact loads.

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 Attach the guards with slack cable equipment suspended from the ceiling so that the axial projection of the wires passes through the center of gravity of the material.
- .2 Install the cables using pass-wires, lug assembly, and other hardware in order to ensure appropriate alignment of the protective devices and prevent bending of the cable attachment points.
- .3 Orient fastening cables attached to equipment suspended from the ceiling so there is 90 degrees between them (in plan), then attach to the ceiling tile so that their angle does not exceed 45 degrees.

-
- .4 A clearing of at least 25 mm must be provided between the seismic devices and other equipment and service element.
 - .5 Adjust cables protection so they allow the normal functioning of the system vibration but not visibly relaxed.
 - .6 Bolt to frame any other equipment that is not insulated against vibration.
 - .1 Install anti-vibration devices according to manufacturers' and the Department's Designated Representatives' instructions and adjust the pins so that the equipment is leveled.
 - .2 Make sure the electric conduits connection to insulated devices does not diminish the flexibility of the vibration isolation system and that the pipes running through walls or floors do not transmit vibrations.
 - .3 When the vibration devices are bolted to the floor, use vibration rubber washers.
 - .4 It is prohibited to attach devices to protect against earthquakes with anchors or fasteners bay nail gun or in holes drilled for this purpose.
 - .5 Install seismic fasteners on all ducts with a diameter of 63 mm and above and install more than 300 mm from the structural ceiling.
 - .6 Install lateral attachments to a maximum of 12.2 mc/c.
 - .7 Install longitudinal ties at a maximum of 24.4 mc/c.
 - .8 Attach the hanging devices and embedded devices on a suspended ceiling with relaxed cables.

3.2 INSPECTION

- .1 Once work completion, the Department's Designated Representative must conduct an inspection of the seismic system. He will then issue a report or a signed letter certifying compliance of facilities with regard to the seismic standards specified and the various manufacturers' recommendations.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).
 - .2 CSA C9, Dry-Type Transformers.
 - .3 Transformers must conform to CSA C802.2 (current addition) bear the certification label on the transformer (CSA Verified).
- .2 National Electrical Manufacturers Association (NEMA)

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 00 Common Work Results for Electrical.

1.3 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal of paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Department's Designated Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

1.4 SEISMIC FASTENERS

- .1 Provide and install all necessary equipment for seismic fasteners as described in Section 26 10 00 – Seismic Fasteners.

PART 2 - PRODUCTS

2.1 TRANSFORMERS

- .1 All transformers are required to come from a single manufacturer.

.2 Description:

- .1 Type: ANN.
- .2 3 phases, 600 V input, 120/208 V output, 60 Hz.
- .3 1 phase, 600 v input, 120/240 V output, 60 Hz.
- .4 Insulation class H, temperature rise 150°C. and steel ventilated enclosure 30-40°C, vibration dampers isomodes until 1200 V, 25 kV for more than 1 200 V.
- .5 Basic Impulse Level: 10 kV.
- .6 Standard Electric Strength.
- .7 Average sound level:

- .1 Tri-phase:

- 45 dB(A) maximum for 10 kVA to 50 kVA.
 - 50 dB(A) maximum for 51 kVA to 150 kVA.
 - 55 dB(A) for 151 kVA to 300 kVA.

- .2 Single-phase:

- 50 dB(A) maximum for 10 kVA to 50 kVA.
 - 55 dB(A) maximum for 51 kVA to 100 kVA.
 - 60 dB(A) for 101 kVA to 167 kVA.

- .8 Impedance at 150°C temperature rise of the coil in ambient temperature between 30 and 40°C.

- .1 Transducer of 45 kVA: 6.9% min to 7.2% max.
Transducer of 50 kVA: 7.6% min to 7.8% max.
Transducer of 75 kVA: 5.9% min to 6.5% max.
Transducer of 112,5 kVA: 4.8% min to 5% max.
Transducer of 150 kVA: 4.7% min to 5% max.

- .2 The impedance described above is based on transducers of brand Delta.

- .9 Efficiency at 170° temperature rise of the coil:

- .1 For transducers up to 50kVA: minimum 94.5%.
 - .2 For transducers from 75 kVA to 200kVA: minimum 96%.

- .10 Armor of type NEMA 2, with removable front metallic panel waterproof from water emitted by sprinkler heads.

- .11 Installation of floor and/or walls according to specifications.
- .12 Clear gray finish ASA no. 61, a according to section 25 05 00 – Common Work Results for Electrical.
- .13 Center tap 2FCNA and 2FCNB, 4-2 ½ %.
- .14 Winding: in copper or in aluminum. Winding in copper is prioritized (design in drawing). Winding in aluminum is accepted if it meets the installation requirements. The contractor is responsible to validate on site the spacing with the other components and according to codes and standards in force.
- .15 Test: in compliance with chapter 7 of standard CSA C9, current edition, dry-type transformer.
- .16 Type zig zag 0° and 30° for the cancellation of harmonics according to specifications.
- .17 Factor K-13 to support harmonics according to specifications.
- .18 Warranty of 10 years pro rata.
- .19 Single electric screen.
- .20 Harmonic treatment 3°, 9°, 15°...secondary and 5°, 7°, 17°, 19°... with 30° of phase displacement on the common primary circuit.
- .21 Neutral capacity at 200% on current of secondary nominal phase.
- .22 Voltage distortion and certified performance tested on testbed for non-linear loads.
- .23 Coils and core of all transformers shall be fixed with anti-vibration shock absorbers.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

- .2 Label size: 7 with registration according to indication of the Department's Designated Representative.

2.3 MANUFACTURERS

- .1 accepted products: Delta, Square-D, Hammond, Marcus, Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA ,as indicated.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Base of suspended transformers must not exceed 3 meters from the finished floor.
- .4 Ensure adequate clearance around transformer for ventilation and as per requirements of the Canadian Electrical Code, part one.
- .5 Install transformers in level upright position.
- .6 Remove shipping supports only after transformer is installed and just before putting into service.
- .7 Loosen isolation pad bolts until no compression is visible.
- .8 Install transformers on damping pad.

3.2 CONNECTIONS

- .1 Make primary and secondary connections as indicated by wiring diagrams.
- .2 If possible, place transformers under tension immediately after installation.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.29-M1989 (R2009), Panelboards and enclosed Panelboards.
- 1.2 SHOP DRAWINGS .1 Submit shop drawings in accordance with Sections 26 05 00 – Common Work Results for Electrical and 01 33 00 - Submittal Procedures.
.2 Drawings shall indicate electric panel characteristics, number, type and size of branch circuit breakers and box dimensions.
- 1.3 PANNELBOARDS DESCRIPTION .1 The description of the panelboards is found in appendix of Section 26 05 05 – Work extent - particular clauses.
- 1.4 EARTHQUAKE-RESISTANT BINDINGS .1 Supply and install the necessary equipment for the earthquake resistant binding such as described in the section 26 10 00.
- 1.5 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

PART 2 - PRODUCTS

- 2.1 PANELBOARDS .1 Panelboards: to CSA C22.2 No.29 and product should be provides by only one manufacturer.

- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements manufacturer's nameplate must show the panelboard and breakers fault current limit.
- .2 250 V and 600 V panelboards: the circuit breakers **nominal interrupting capacity and the symmetrical short circuit capacity of panelboards will have** to be according to plans and specifications but never inferior, on any account, than 22 kA at 600 V and in 10 kA at 250 V.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and all panelboards keyed alike.
- .6 Copper or aluminum bus with neutral of same Amp rating as mains.
- .7 All the panelboards must be provided with a grounding bar.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 The front panel must be provided with a left hand hinge with holding bolts to the right in order to facilitate the access for the maintenance staff.
- .11 Trim and door finish: baked grey enamel.
- .12 Install devices allowing the addition of additional circuit breakers for all the unused spare spaces.

2.2 SERIAL PROTECTION

- .1 Downstream panel boards have to be full nominal capacity or be of integrated nominal capacity with upstream protection devices. If the manufacturer uses the second option, he will have to provide an evidence of the laboratory testing certifying correct operation of the system and indicate on the equipment nameplate the equipment test current (kA eff. sym.), the specific upstream protection device, the acceptable branch breaker interrupting

PANELBOARDS BREAKER TYPE

capacity, the panel designation and the system voltage, the whole such as mentioned in the article 14-014 of the Canadian Electrical Code , Part one.

2.3 CIRCUIT BREAKERS

- .1 Circuit breakers: to Section 26 28 16.02 - Molded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for emergency lighting circuits.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 MANUFACTURER

- .1 Acceptable products: Cutler-Hammer Siemens, Square D, FPE or GE.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.

- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 When panelboards are installed side by side, the box must be welded together and be of the same size, doors must be separated, of the same size and perfectly aligned.
- .7 Provide every circuit of outlet and 120 VCA service of its own neutral and do not use a common neutral for several circuits. A common neutral for the splitting of lighting can be provided in compliance with the Canadian Code of electricity, First part.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.2 SHOP DRAWINGS
AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures. Documents and samples to submit and 26 05 00 - Common Work Results for Electrical.
- .2 Submit a set of drawings for each model of outlets and switches specified.
- .3 Drawings should clearly identify the following:
- Manufacturer
 - Model
 - Description
 - Amp and voltage
 - NEMA Configuration
 - Catalogue number
 - Color
 - Performances:
 - ✓ Electric
 - ✓ Mechanic
 - ✓ Environmental
 - Material
 - ✓ Front
 - ✓ Back
 - ✓ Contact
 - Dimensions

1.3 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at

WIRING DEVICES

appropriate recycling facilities.

- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to a metal recycling facility as approved by Department's Designated Representative.

PART 2 - PRODUCTS

2.1 SWITCHES

- .1 15 or 20 A, 120-277 V,c.a or 347 V c.a single pole, double pole, three-way, four-way switches, as indicated.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggles or as per engineer.
- .3 Toggle switches: fully rated for tungsten filament and fluorescent lamps, and up to 120% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.
- .5 Acceptable materials:

	<u>Hubbell</u>	<u>Leviton</u>	<u>Seymour</u>
.1 120v 15A 1 pole	HBL1201W	1201-2W	PS15AC1W
.2 120V 20A 1 pole	HBL1221W	1221-2W	PS20AC1W
.3 347V 15A 1 pole	HBL18201WCN	18201-W	PS371510
.4 347V 15A 1 pole	HBL18203WCN	18221-W	PS372010

WIRING DEVICES

2.2 RECEPTACLES

.1 Receptacles, 125 V ac as per manufacturers acceptable material :

	<u>HUBBELL</u>	<u>LEVITON</u>	<u>PASS & SEYMOUR</u>
.1 Simple 15 A Conf. 5-15R	HBL5251	5251-W	5261
.2 Double 15 A Conf. 5-15R	HBL5262W	5262-W	5262AW
.3 Double 20 A Conf. 5-20R	HBL5362W	5362-W	5362AW
.4 Simple 30 A Conf. 5-30R	HBL9308	5371	3802
.5 Simple 15 A Locking Conf. L5-15R	HBL4710	4710	4710
.6 Double 15 A Locking Conf. L5-15R	HBL4700	4700	4700
.7 Simple 20 A Locking Conf. L5-20R	HBL2310	2310	L520-R
.8 Double 15 A DDFT Conf. 5-15R	GF5262WA	7599-W	N/A
.9 Double 20 A DDFT Conf. 5-20R	GF5362WA	7899-W	N/A

.2 Receptacles 120/240 V ac:

	<u>Hubbell</u>	<u>Leviton</u>	<u>Seymour</u>
.1 simple 30 A Conf. 14-30R	HBL9430A	278	3864
.2 simple 50 A Conf. 14-50R	HBL9450A	279	3894

.3 Plugs in white color or as per Department's Designated Representative's choice.

2.3 COVER PLATES

- .1 Provide all outlets and wiring devices and cover plates.
- .2 Cover plates from manufacturers either: Hubbell, Leviton or Pass & Seymour.
- .3 Galvanized steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Cover plates, stainless steel non-magnetic (# 302) brushed

vertically 1 mm thick for wiring devices like hospital grade mounted outlet boxes or recessed surface.

- .5 Stainless steel cover plates (# 430) brushed vertically 1 mm thick for wiring devices mounted in outlet boxes or recessed surface.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates complete with gaskets for duplex receptacles as indicated.
- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results – Electrical, as indicated.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results – Electrical, as indicated.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
 - .4 Identify panel and circuit numbers in correspondence on all wiring devices by using a white adhesive strip type P-

Touch. This adhesive strip must extend beyond the width of the plate (10 mm each side), in order to return it and stick to the back.

Lettering color: Black

- .4 Box type FS and FD
 - .1 Coordinate with general contractor the installation of recessed box so that the surface of the box is at the same level as the surface of the wall. Seal around box before installing cover plate.
- .5 General
 - .1 location of all output sockets and switches according to section 26 05 00 – General requirements or as indicated.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian Standard Association (CSA)/ CSA International
 - .1 Low-voltage HRC fuse of specified type, in compliance with standard C22.1 and C22.2 no 106.
 - .2 Standard cartridge fuses in accordance with standard CSA C22.2 no 248.
- 1.2 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and 26 05 00- Common work results for electrical
- 1.3 SHOP DRAWINGS AND DATA SHEETS
- .1 Provide shop drawings and data sheets in accordance with Section 01 33 00 - Submittal Procedures and 26 05 00- Common work results for electrical.
 - .2 Provide fuse performance data characteristics for each fuse type and size above 5 A. Performance data to include: average melting time-current characteristics, the I²t value (to establish the fuse coordination) and the maximum allowable electric current.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of New Brunswick, Canada.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Ship fuses in original containers.
 - .2 Do not ship fuses installed in switchboard.
 - .3 Store fuses in original containers in storage cabinet and in moisture free location.
 - .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

FUSES - LOW VOLTAGE

1.5 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Three (3) spare fuses of each type and size installed above 600 A.
- .3 Three (3) spare fuses of each type and size installed up to and including 600 A.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

- .1 Fuse type references L1, L2, J1, J1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 Class L fuses, for all fuses over 600 A.
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
- .2 Class J fuses, for all fuses up to 600 A.
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.
 - .3 Type HSJ for the supply of variable frequency drive system.
- .3 Class R -R fuses.
 - .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 Class C fuses, for short circuit protection and not overload protection.

FUSES - LOW VOLTAGE

2.3 MANUFACTURERS

- .1 Accepted manufacturers: Gould Shawmut, Buss, GEC.

2.4 FUSE STORAGE
CABINET

- .1 Cabinet for storage of fuses, made of aluminum sheet 2.0 mm thick, with 750 mm height, 600 mm wide and 300 mm deep, fitted to the front of a door access lock with key brand ILCO # 575, hinged and compartments (one compartment for each type and size of fuse). Finished to Section 26 05 00 - General Requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically match mounting devices.
- .1 Install rejection clips for Class R fuses.
- .3 Ensure correct fuses installation to protect assigned electrical circuit.
- .4 Where UL Class RK1 fuses are specified; install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
- .5 Use fast-action fuses for resistive loads.
- .6 Use time delay fuse for all other type of loads.
- .7 Select the fuse capacity according to the charging current measured for each driving power.
- .8 Install storing cabinet for fuses in designated area by the electricity representative and the Department's Designated Representative.
- .9 Install spare fuses in fuse storage cabinet.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 26 05 00 – Common Work Results for Electrical and Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .3 Provide all available data related to values of interrupting capacity of short-circuit current and I^2t maximum values allowable for all circuit breakers.
- .4 Supply the circuit breaker certificate to manufacturer.

1.3 AUTHENTICATION

- .1 Before proceeding to any installation of circuit breakers in a new or existing installation, the electrical contractor must submit in three (3) copies the manufacturer certificate of origin drafted in English duly signed by the factory and the local representative of the aforementioned manufacturer, giving evidence that all the circuit breakers supply are new and that they meet the standards and regulations in force. These certificates must be submitted to the engineer for acceptance.
- .2 A delay in the production of the certificate of authentication will not justify an extra to the contract nor any additional compensation.
- .3 Any manufacturing work, assembly or installation must not start before the acceptance of the certificate of authentication by the engineer. For lack of conforming to this requirement, the engineer and/or the user customer reserves the right to appoint the manufacturer registered on circuit breakers to authenticate all the new circuit breakers planned to the contract at the expense of the

electrical contractor.

- .4 Generally, the certificate of authentication has to contain:
 - .1 The name and the coordinates of the manufacturer and the person responsible for the authentication. The person responsible has to date and sign the certificate;
 - .2 The name and the coordinates of the authorized distributor as well as the person responsible for the distributor on the account of the contractor.
 - .3 The name and the coordinates of the person responsible for the project for the contractor.
 - .4 The name and the address of the building where circuit breakers will be installed:
 - .1 The title of the project (title on the plans or specifications);
 - .2 The customer's reference number;
 - .3 The list of circuit breakers in the form of table when required.

1.4 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 BREAKERS
GENERAL

- .1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers and Accessory high-fault protectors.
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 All the circuit breakers of 300 amp. and more must be provided with auxiliary contacts wired on terminal blocks indicating the open or close position of the circuit breaker and to have a ground fault protection " L.S.I.G ".
- .7 All the circuit breakers having a break capacity of 14 kA and more must be supplied with a locking device by padlock in position "closed" or "opened".
- .8 Circuit breakers must have a symmetric interrupting capacity of at least 10 kA at 250 V and 14 kA at 347 V.

2.2 THERMAL
MAGNETIC BREAKERS
[DESIGN A]

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .2 According to the short circuit level indications, circuit breakers must offer the possibility of a serial protection, that is the main circuit breaker upstream to a panel has to protect short circuited breakers downstream to the panel when these last ones don't have the required short circuit interrupting capacity.

2.3 MAGNETIC
BREAKERS [DESIGN B]

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.
- .2 Use these circuit breakers for the magnetic starters combined with circuit breaker.

2.4 CURRENT
LIMITING AND SERIES
RATED THERMAL
MAGNETIC BREAKERS
[DESIGN C]

- .1 Thermal magnetic breakers with current limiters.
 - .1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.
 - .2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.
 - .3 Fuses can be removed separately and are interlocked to the circuit breaker. The release of the circuit breaker occurs when a fuse or its lid is removed or on fuse blow-out.
- .2 According to the manufacturer's indications and the directives, the current limiting circuit breakers or circuit breakers for serial installation are used when the available short circuit current exceeds the standard thermal magnetic circuit breakers interrupting capacity.
- .3 Magnetic circuit breakers will only be used when protecting against the short circuits only.
- .4 Circuit breakers for serial installation are recommended for the installations susceptible to present leakage currents. Before prescribing circuit breakers for serial installation, the requirements relative to the coordination and to the reliability of the system must be examined.
- .5 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice. Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE
TRIP BREAKERS
[DESIGN D]

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time instantaneous tripping for phase ground fault short circuit protection.

2.6 INSULATED CASE CIRCUIT.1
BREAKERS

- .1 Insulated case circuit breakers with electronic activated release mechanisms which can operate without external source and having an inverse time / current curve in overload conditions and long delay, short delay and instantaneous protection for phase conductors short circuits and ground faults.
- .2 Insulated case circuit breakers have to present the following characteristics:

- .1 Release mechanism with deferred direct action, with reels conceived for a nominal cutting range of 80 to 160 % of their nominal value, in overload conditions.
- .2 Release mechanism with immediate action conceived for a nominal cutting range of 500 to 1 500 % of the nominal intensity of the circuit breaker, assuring a protection against the short circuits.
- .3 Accumulated energy operating mechanism, allowing fast closure.
- .4 Accumulated energy operating mechanism allowing fast closure with motorized spring charging and manual override lever in case of emergency and a switch to switch off the motorized spring charging electrical supply.
- .5 On-Off and spring charging light indicator.

2.7 OPTIONAL
FEATURES

- .1 Include:
 - .1 Shunt trip.
 - .2 Auxiliary switch.
 - .3 Motor-operated mechanism c/w time delay unit.
 - .4 Under-voltage release.
 - .5 On-off locking device.
 - .6 Handle mechanism.

2.8 MANUFACTURER

- .1 Acceptable products : Cutler-Hammer, Siemens, Square D, FPE, GE.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Provide with locking devices the circuits enumerated in the section 26 24 16.01 - Circuit breakers panelboards.
- .3 The order in which circuit breakers are mounted in the panelboards must follow the order specified to the plans.

PART 1 - GENERAL

- 1.1 PAYMENT PROCEDURES .1 Payment for field testing of ground fault equipment performed by Contractor in accordance with Section 01 29 83 - Payment Procedures: Testing Laboratory Services.
- 1.2 REFERENCES .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA-C22.2 No.144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
- .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.
- 1.3 SUBMITTALS .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and 26 05 00 - Common work results for electrical.
- .2 Submit product data and shop drawings.
- .3 Submit test report for field testing of ground fault equipment to the Department's Designated Representative and a certificate that system as installed meets criteria specified herein.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by the Engineer.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 DESCRIPTION
- .1 Double protected outlet. Only for grounding networks (class "A"), less than 6mA.
 - .2 Heating cable network. Only by networks of heating cables for supply (class "B") 30 mA.

- 2.2 MATERIALS
- .1 Components comprising ground fault protective system to be of same manufacturer.

- 2.3 BREAKER TYPE
GROUND FAULT
INTERRUPTER
- .1 Single and double pole ground fault circuit interrupter for 1 phase circuit c/w test and reset facilities.

- 2.4 GROUND FAULT
LIFE PROTECTOR
- .1 Double and triple pole circuit breaker to supply power to mains of phase panel and complete with:
 - .1 Automatic shunt trip breaker.
 - .2 Zero sequence current sensor.
 - .3 Facilities for testing and reset.
 - .4 CSA Enclosure, surface mounted.
 - .5 Ground fault trip indicator light.

- 2.5 GROUND FAULT
PROTECTOR UNIT
- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 CSA approved housing, mounted flush with front plate in stainless steel (# 430).

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Do not ground neutral on load side of ground fault relay.
 - .2 Pass phase conductors, including neutral, through zero sequence transformers.

3.2 FIELD QUALITY
CONTROL

- .3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.
- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control.
- .2 Arrange for field testing of ground fault equipment by independent testing laboratory, ground fault equipment manufacturer or Contractor before commissioning service.
- .3 Submit test reports to the Engineer and a certificate stating that all protection systems meet these specifications criteria.
- .4 Demonstrate simulated ground fault tests.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International).
- .1 CAN/CSA C22.2 No.4, Enclosed Switches.
.2 CSA C22.2 No.39, Fuseholder Assemblies.
- 1.2 SUBMITTALS .1 Submit product data in accordance with Section 01 33 00 -
Submittal Procedures and section 26 05 00 Common Work
Results for Electrical.
- 1.3 HEALTH AND SAFETY .1 Do construction occupational health and safety in accordance
with Section 01 35 29.06 - Health and Safety Requirements.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance
with Section 01 74 21 - Construction/Demolition Waste
Management and Disposal.
- .2 Remove from site and dispose of packaging materials at
appropriate recycling facilities. Verify if the contractor provides
that type of service.
- .3 Collect and separate for disposal paper, plastic, polystyrene,
corrugated cardboard packaging material in appropriate on-site
bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated
containers all steel, metal, plastic waste in accordance with
Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for
recycling.

PART 2 - PRODUCTS

- 2.1 DISCONNECT SWITCHES .1 Fusible, non-fusible, disconnect switch in CSA Enclosure :
- .1 Type 1 for indoor use.
.2 Type 2 for indoor use where dripping or light splashing of
liquids is possible

- .3 Type 3R for outdoor use,
- .4 Type 4 to protect against hose-directed water
- .5 Type 5 for indoor use to protect against falling dirt and against settling airborne dust, lint, fibers, and flyings,
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Bypass device to allow door opening when handle in ON position.
- .5 Quick-make, quick-break action
- .6 ON-OFF switch position indication on switch enclosure cover.
- .7 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage,
- .8 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .9 Early break CSA certified auxiliary contact when use with variable speed drive.
- .10 Provide solid neutral point when use on system: 120/240 V, single phase, three wires; 120/208 V, three phases, four wires; 347/600 V, three phases, four wires.
- .11 All supplied disconnect switch shall be from the same manufacturer.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 MANUFACTURER

- .1 Nameplate supplied and installed as per section 26 05 00 - Common work result for electrical.
- .2 Disconnect switches manufacturer shall be the same as for electrical distribution panel

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install switches and fuses as indicated
- .2 Install auxiliary contacts as required by 2.1.9 and the necessary wiring (even if not indicated on plans) between disconnect switch and upstream variable frequency drive (connection in series with variable frequency drive stop command).

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14-, Industrial Control Equipment.
 - .2 Electrical Equipment Manufacturers Association of Canada (EEMAC)
 - .1 Industrial Control and system.
 - .3 National Electrical Manufacturers Association (NEMA).
- 1.2 PRODUCT DATA
- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
 - .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Consultant.

PART 2 - PRODUCTS

- 2.1 CONTACTORS
- .1 Electrically held, permanent magnet latch type, mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
 - .2 Switch combined with a circuit breaker or fuse to a switch as indicated.
 - .3 Contactors fitted with two (2) Auxiliary contact normally open and two (2) Auxiliary contact normally closed, unless otherwise indicated.

CONTACTORS

- .4 Mount in CSA Enclosure type 1 unless otherwise indicated.
- .5 Include following options in cover:
 - .1 Green LED indicator.
 - .2 Stop-Start pushbutton.
- .6 Control transformer with a secondary 120 V or 24 V as indicated and mounted in the switch housing.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Size 4 nameplate indicating name of load controlled.

2.3 MANUFACTURER

- .1 Products accepted: Cutler-Hammer, Siemens, Square D, Allen-Bradley, Telemecanique, Asco.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the switches and connect the auxiliary control devices, as indicated.

PART 1 – GENERAL

- 1.1 REFERENCES
- .1 International Electrotechnical Commission (IEC).
 - .2 IEC 947-4-1, Part 4, Electromechanical Contactors and Starters.
 - .3 CSA C22.2 No. 14, Current edition - Starters and Contactors.
 - .4 CSA C22.2 No. 66 - Control Transformer.
- 1.2 SAMPLES / DESIGN AND TECHNICAL WORKSHOPS
- .1 Submit samples, shop drawings, and specifications in accordance with the requirements of sections 01 33 00 – Submittal Procedures Submit and 26 05 00 – Common Work Results for Electrical.
 - .2 Datasheets:
 - .1 Submit required data sheets, specifications, and manufacturer's documentation for products. The sheets must indicate the product characteristics, performance criteria, dimensions, boundaries, and finishing.
 - 3 The drawings must indicate the following for each type of starter:
 - .1 The method of mounting and dimensions;
 - .2 The caliber and type of starters;
 - .3 The arrangement of the elements described, mounted on the front panel and inside the box;
 - .4 Types of cases or boxes;
 - .5 Wiring diagrams / wiring;
 - .6 Patterns of interconnection.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Provide materials / equipment replacement required in accordance to Section 01 78 00 – Closeout Submittals.
 - .2 Submit the operating and maintenance records of each type and model of starter and attach to the maintenance manual, as mentioned in Section 26 05 00 – Common Work Results for Electrical.

- .3 Materials / Additional Materials
- .1 Provide a complete set of spares for each type and size of starter:
- .1 A (1) switch for each class
 - .2 Two (2) modules of auxiliary contacts 1 NO and 1 NF for each class;
 - .3 Two (2) Control Transformers;
 - .4 Two (2) fuses for transformer;
 - .5 Four (4) LED lights for each color
 - .6 Six (6) fuses of each size
 - .7 A (1) set of overload block for each capacity.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- .1 Transport, store and handle materials and equipment in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials and equipment to the site in their original packaging, which must bear a label stating the name and address of the manufacturer.
- .3 Management of packaging waste can recover packaging waste for recycling / reuse and recovery, pallets, crates, quilting, and other packaging materials by their manufacturers in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- 1.5 STARTERS CONTROL
- .1 Mechanical and ventilation controls are generally described in Section 23 00 00 and in the drawings of this discipline. The contractor of the division 26 00 00 must refer to these plans and section 23 00 00 to generate patterns of each starter (one-start control scheme is required).

PART 2 – PRODUCTS

- 2.1 MATERIAL/GENERAL
- .1 Starters: to IEC 947-4 with AC4 utilization category and AMEEC E14-1 standards.
- .1 Half-power (half-size) starters are not accepted.
 - .2 Single phase starters size 0 minimum required.
 - .3 The three phase starters size 1 minimum required.

- .4 For all three phase motors 1 HP and more, provide starters with detector loss / phase imbalance type standalone module or integrated overload relay. A technical explanatory paper should be included with the shop drawings for approval.
- .5 Provide the necessary boundaries for stop/start remotes and install a jumper on the terminal when not used.
- .6 Coordinate with Division 23 00 00 for the supply of engine starters in this division.
- .7 All starters must be provided by the same manufacturer.
- .8 Check the plans from the division 23 00 00 for the wiring diagrams and interconnection for starters if applicable.
- .9 Manufacturers accepted (starters): Siemens, Cutler-Hammer, Allen-Bradley, Schneider, Ge.

Manufacturer accepted (detector phase loss autonomous if applicable): Controlab "DSP1L-GB" Gould "DLM", Entelec "ASN".

2.2 MANUAL STARTERS

- .1 Manual starters, three phases or single phase, type, power rating and enclosure type as indicated, equipped with the following:
 - .1 Switch mechanism to prompt action;
 - .2 One or three component (s) thermal protection against overload, manual reset, with remote indicator trigger.
- .2 Accessories:
 - .1 Toggle switch for heavy duty jobs identified as indicated;
 - .2 LED heavy duty lamps type and color red or as indicated.
- .3 Lockout device for "on" and "off" position.

MOTOR STARTERS TO 600 V

2.3 MAGNETIC STARTERS AND.1
FULL VOLTAGE REDUCED
VOLTAGE

Starters magnetic gauge, type, power rating and enclosure type as indicated, equipped with the following:

- .1 Full voltage with fast-acting starter contactor (s) solenoid.
 - a) non-inverter: a contactor.
 - b) inverter: the two contactors mounted on the same base and interlocking device to prevent the simultaneous operation of two contactors.
 - c) Two speeds and two windings: the two contactors.
 - d) Two speeds and a winding: three contactors
 - e) Autotransformer: three circuit switches to closed transition.
- .2 Device for protection against overloads for each motor phase, manual reset from the outside of the box.
- .3 Wiring diagram / principle placed in a clearly visible inside the box.
- .4 Each wire and each terminal equipped with a permanent digital tracking, corresponding to the wiring diagram / principle, so as to facilitate the connection of the son of arrival within the starter.
- .2 Combination starters fitted with a fuse switch, switch the circuit breaker or a motor actuated by a lever placed outside the cabinet, with:
 - .1 Lock in off position using one, two or three padlocks;
 - .2 Cabinet door equipped with a separate lock;
 - .3 Setting prohibiting that the engine starts when the enclosure door is open.
- .3 Autotransformer starters, with transition to closed circuit, size, type and rated according to the indications of the type indicated in box, equipped with the following:
 - a) Three-pole contactors;
 - b) Autotransformer with 50%, 65% and 80% plugs;
 - c) Adjustable pneumatic timer relay;

MOTOR STARTERS TO 600 V

- d) Tripolar device protection against overloads, and manual reset;
 - e) Protective device against overheating auto transformers.
- .4 Common accessories for starters:
- .1 Pushbuttons or selectors: for repeated intense service as indicated.
 - .2 Warning lights for heavy duty, type and color indicated.
 - .3 Unless otherwise stated, a normally open auxiliary contact and a reserve, normally closed.
 - .4 Auxiliary control devices as indicated.
- .5 Reduced voltage starters electronic / progressive type and combined class, type, power rating and enclosure type as indicated and equipped with the following:
- .1 Controller of torque (TCS) semiconductor comprising:
 - Acceleration / deceleration ramps and limitations time / current
 - Acceleration / deceleration ramp and control of engine torque
 - Acceleration time / deceleration configurable
 - Adjustment of the current limit
 - Integrated adjustable overload protection, phase loss and unbalance.
 - .2 Contactor bypass with external overload relay including a separate switch and indicator light.
 - .3 Electronic module and power switch for full capacity isolated bypass voltage of 690 volts minimum at 60 Hz.
 - .4 Unit isolation with protection fuses or circuit breakers as indicated by a lever operated outside the enclosure and a device:
 - .1 install three padlocks in the OFF position;
 - .2 lock in "on" position;
 - .3 lock the cabinet door independently;

MOTOR STARTERS TO 600 V

- .4 prevent to turn the starter on when the cabinet door is open.
- .5 Capacity units sectioning:
 - Circuit breaker (14 KA RMS symmetrical minimum at 600 V, 3 phase or more according to indications) or
 - Switches with fuses (fuses form 1, type J-acting delayed)

<u>Starters (AMEEC)</u>	<u>Sectioning units</u>
- Caliber 1 / 10 HP*	30 AMP
- Caliber 2 / 25 HP*	60 AMP
- Caliber 3 / 50 HP*	100 AMP
- Caliber 4 / 100 HP*	200 AMP
- Caliber 5 / 200 HP*	400 AMP

* under a 600 V tension

- .6 Capacity of magnetic starter contactors:

The switches must be of capacity:

- AMEEC "size" to 600 volts, 3 phase according to the following table:

<u>(AMEEC) Caliber</u>	HP	Continuo us amperage descontac tors (excluding boxes)
1	10 HP*	30 amps
2	25 HP*	60 amps
3	50 HP*	100 amps
4	100 HP*	200 amps
5	200 HP*	300 amps

* under a 600V tension.

- .7 Capacity modules starters electronic / progressive.

The modules must have the capacity to start severe (heavy duty) by the following table:

HP until	Motor Capacity of power electronics module	Capacity of external bypass contactor
10 HP*	15 amp.	30 amp.
25 HP*	35 amp.	60 amp.
50 HP*	65 amp.	100 amp.
100 HP*	125 amp.	200 amp.
200 HP*	250 amp.	300 amp.

* under a 600V tension.

The modules must be equipped with protective device under load and overload can be programmed into the starter. A preheat function to avoid condensation of the engine may also be activated as needed as indicated.

- .5 Device for protection against overloads for each motor phase, manual reset from the outside of the housing.
- .6 Unless otherwise specified, relays for connecting the thermistor thermal protection for motors 30 HP and above and protections 'RTD' engines of 125 HP and more, this protection must be integrated into soft starter;
- .7 Transformer Control ;
 - .1 Control transformer, dry, single phase, with primary voltage as indicated and the secondary voltage of 120 V, equipped with fuses in the primary and secondary, connected in circuit with the starter.
 - .2 Rated transformer control determined by the load control circuit and a safety margin of 20%, 100 VA minimum.
- .8 Terminals for power supply circuits and control;
- .9 Wiring diagram and connections placed at a conspicuous place inside the box;
- .10 Each wire and each terminal marked by a permanent numerical designation, similar to that shown on the wiring diagram in order to facilitate the connection of the son of arrival within the starter;
- .11 Materials to provide if no control chart is provided:

- .1 3 position selector "Manual-Off-Automatic" for each type solid starter;
- .2 LEDs D.E.L. solid green for walking and amber for fault;
- .3 An open contact and a closed contact on each contactor in addition to interlocking contacts
- .12 Additional accessories to provide ACCORDING TO SPECIFICATION
 - .1 Ammeter three phases with instant playback calibrated to 200% of current engine operation complete with current transformers movement 5 amps and phase switch.
 - .2 Voltmeter of 3 phases and scale 0-750 volts, protection fuses and selector stages
 - .3 Counter hours of operation at 120 V, 60 Hz display in hundredths of hours.
- 2.4 BOXES AND FINISH
 - .1 AMEEC type 1 and in accordance with this section.
 - .2 Finish boxes accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.
- 2.5 DESCRIPTION OF EQUIPMENT
 - OF.1 Nameplates provided and installed in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.
 - .2 Nameplates manual starters, size 1, lettering, in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.
 - .3 Nameplates magnetic starters, five format, lettering in accordance with Section 26 05 00 – Common Work Results for Electrical.

PART 3 – EXECUTION

- 3.1 INSTALLATION
 - .1 Install starters and control devices. Make connections to supply circuits and control as indicated.
 - .2 Ensure that circuit breakers, fuses and over intensity protective

devices are properly rated.

- .3 Confirm the information on the nameplates of motors and make the appropriate settings of protective devices against overloads.

3.2 TESTING / QUALITY.1
CONTROL ON SITE

Make a test in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.

- .2 Set the elements of protection by amperage indicated on the nameplates of the motors. Do not adjust the overload protections beyond the rated service factor (1.0) engines.

Do not exceed 13 times the rated current of engines for the coverage of short-circuit breakers. Use protection for dual element fuses.

However, verification, testing, tuning, programming parameters and commissioning at site will be performed by a qualified representative duly authorized by the manufacturer.

- .3 For all the engines in question, set all the security settings of the electronic modules starters and ramps, acceleration / deceleration of reduced voltage starters progressive (TRP). All programming parameters starters shall conform to the requirements and recommendations of the suppliers of equipment.
- .4 Operate switches and contactors to ensure their proper functioning.
- .5 Perform start and stop sequences for each contactor and relay.
- .6 Ensure controls sequential interlocks between starters related equipment and control devices operate as specified.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F 1137, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.9, for lighting devices.
 - .2 CSA C22.2 No.43, for screw-cap sockets.
 - .3 CSA C22.2 No.74, for electric discharge lamps.
 - .4 CSA C22.2 No. 141 for unit equipment for emergency lighting.
- .5 ICES-005 Radio Frequency Lighting Devices.
- .6 Underwriters' Laboratories of Canada (ULC)
- .7 All electric systems shall be in compliance with the Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 26 05 00 – Common work results for electrical.

LIGHTING

- .2 Quality assurance submittals: provide following in accordance with Section 01 45 00 – Quality Control.
 - .1 Manufacturer’s instructions: provide manufacturer’s written installation instructions and special handling criteria, installation sequence, cleaning procedures, etc.

1.3 SHOP DRAWINGS
AND DATA SHEETS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 26 05 00 – Common work results for electrical.
- .2 Shop drawings shall come from the company fabricating devices and include those of lamps and ballast with their characteristics.
- .3 Product Data:
 - .1 Provide manufacturer’s printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Complete photometric data shall be prepared by independent testing laboratory and include: total power absorbed (in watts), candlepower, spectral distribution, lumen, lighting performance standard, utilization factor, lamp and ballast type and the company’s designation.
- .4 These data shall include, if necessary; table illustrating the PVC rate and spacing requirement of devices.
- .5 For all products subjected to accepted equivalent in these specifications; provide calculations point by point for rooms and exterior areas.

1.4 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

 LIGHTING

- .4 Divert unused metal materials from landfill to metal recycling facility.

1.5 EARTHQUAKE-RESISTANT
FIXATIONS

- .1 Provide and install all necessary material for an earthquake-resistant fixation as described in section 26 10 00 – Earthquake-resistant fixations.

PART 2 - PRODUCTS
2.1 MATERIAL

- .1 Provide interior and exterior lighting devices described in section 26 05 05 of specifications, complete with all required accessories for their installation and efficiency, such as ballasts, gypsum frames, suspensions, seal fill, lamp insulation, etc. Sockets of fluorescents coated with a silver plate in order to ensure a positive contact with lamps for a complete installation.
- .2 Lamps and ballast shall come from the same manufacturer. A minimum warranty of 5 years shall be provided by the manufacturer.
- .3 Accepted manufacturer:
- .1 Fluorescent lighting device: Cooper (Metalux), Peerless, Canlyte-CFI, Hubbell, Thomas and Day-Brite.
- .2 DHI lighting device: Lumec, Keene, Widelite, Prescolite, Hubbell, and Day-Brite
- .3 Explosion-proof and non-corrosive device: Appleton, Thomas & Betts, Crouse-Hinds, Ipex, Hubbell.

2.2 LAMPS

- .1 Lamps capacities should not exceed manufacturer's recommendation of devices.
- .2 All lamps shall be put in place and in good condition at the provisional acceptance date.
- .3 All fluorescent and high intensity discharge lamps burnt out 12 months following the provisional acceptance date will be replaced.
- .4 Provide the owner, as spares, 5% of the total number of each lamp type installed (minimum one (1) lamp).

LIGHTING

- .5 All HSP lamps shall have low mercury content and no cycling at the end of service life.
- .6 Supply and install all required lamps for each lighting device. All lamps shall come from the same manufacturer.
- .7 Accepted manufacturers: Philips (Advance series), G.E. (Ecolux series), Osram-Sylvania (Ecologic series).
- .8 Fluorescent lamp of ecologic type with appropriate marking:

Bulb shape and power in watts	Base	Approx. initial lumens	Hour lamp life	Description	Minimum color rendering
T5-28	Miniature 2 pins	2900	20000	4100°K	85
T5-54	Miniature 2 pins	5000	25000	4100°K	85
T8-28	Medium 2 pins	2725	24000	4100°K	85
T8-32	Medium 2 pins	3000	24000	4100°K	85

Unless otherwise indicated, fluorescent tubes will be the T-8, 32 W, 4100 ° K in general, 24 000 hours and a color rendering (CRI) of 85 minimum low mercury content (green).

- .9 Metal halide lamps:

Bulb shape and power in watts	Base	Approx. initial lumens	Hour lamp life	Description	Minimum color rendering
BT-37-400	Mogul	36000V 32000H	15000	Clear-base up	65
BT28-250	Mogul	22000V 20000H	10000	Clear	65
BT28-175	Mogul	15000V 12900 H	7500	Clear	65
ED17-150	Medium	13000	10000	Clear	65
ED17-100	Medium	8500	10000	Clear	65
ED17-70	Medium	5200	10000	Clear	65
MP70-100	Medium	3200/5600	7500	3200°K	75
MP150	Medium	8800	5000	3200°K	75

 LIGHTING

.10 High pressure sodium lamps:

Bulb shape and power in watts	Base	Approx. initial lumens	Hour lamp life	Description	Minimum color rendering
E25-1000	Mogul	140000	24000	Clear	20
ED18-400	Mogul	50000	24000	Clear	20
ED18-250	Mogul	29000	24000	Clear	20
ED18-200	Mogul	22000	24000	Clear	20
ED17-150	Medium	16000	24000	Clear	20
ED17-100	Medium	9500	24000	Clear	20
ED17-170	Medium	6300	24000	Clear	20
ED17-50	Medium	4000	24000	Clear	20
ED17-35	Medium	2250	24000	Clear	20

2.3 BALLASTS

- .1 Use automatic start-up lamps and ballasts for areas where lighting devices are turned on the majority of the time.
- .2 All ballasts are equipped with plug connectors.
- .3 Fluorescent ballast: CBM and CSA certified, energy efficient type:
- .1 Rating: 60 Hz, voltage as indicated, for use with rapid start lamps.
 - .2 Electronic type.
 - .3 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .4 Power factor: minimum 98% of rated lamp lumens.
 - .5 Current crest factor: 1.7 maximum.
 - .6 Harmonics: 10% maximum THD.
 - .7 Operating frequency of electronic ballast: 20kHz minimum.
 - .8 Sound rated: Class A.
 - .9 Mounting: remote or integral with lights.

LIGHTING

- .10 Ballast factor: greater than 0.88.
- .11 Capacitor: thermal protection, not containing PBCs.
- .12 Thermal protection: automatic recovery, on coil.
- .13 Efficiency superior to 84 Lum/Watt.
- .14 Ballasts shall be electronic of class 3. Ballasts shall be from brand Phillips (Advance Centium series), G.E. (ULT HP series) or equivalent Osram (QT series).
- .4 Metal halide ballast:
 - .1 Rating: 60 Hz, voltage as indicated, for use with metal halide lamp. Provide circuitry for quartz re-strike standby light where indicated.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .3 Power factor: minimum 95% with 95% of rated lamp lumens.
 - .4 Type: constant wattage autotransformer, isolated secondary and solid state.
 - .5 Capacitor: does not contain PCBs.
 - .6 Input voltage range: plus or minus 5% of nominal.
 - .7 Minimum starting temperature: minus 34 degrees Celsius at 90% line voltage.
 - .8 Mounting: indoor, outdoor, remote and integral with light, according to specifications.
 - .9 Current crest factor: 1.7 maximum current.
 - .10 Accepted products: Advance, Philips, G.E, Osram.
- .5 High pressure sodium ballast: to ANSI C82.4 design.
 - .1 Rating: 60Hz, voltage as indicated, for use with high pressure sodium lamp.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.

 LIGHTING

- .3 Power factor: minimum 95% with 95% of rated lamp lumens.
- .4 Type: inductive, capacitive, controlled magnetic semiconductors. Choose the appropriate boot device, recommended by the manufacturer.
- .5 Capacitor: does not contain PCBs.
- .6 Input voltage range: plus or minus 10% of nominal.
- .7 Minimum starting temperature: minus 40 degrees Celsius at 90% line voltage.
- .8 Mounting: indoor, outdoor, remote and integral with lights, according to specifications.
- .9 Current crest factor: 1.7 maximum current.
- .10 Accepted products: Advance, Philips, G.E, Osram.

2.4 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.
- .2 Unless otherwise specified in the lighting devices listings, boxes and reflectors shall be in cold rolled steel of size 20. Metal surfaces of boxes and reflectors shall be covered by a coat of oven-baked enamel with very uniform finish, free of corrosion pinholes and defects.
- .3 Cover in polyester oven-baked powder.
 - .1 Reflectors and metallic surfaces of boxes shall have a cover very glossy in polyester powder paint, showing a smooth finish, and free of pinholes and defects.
 - .2 Reflectors finish and other interior surfaces shall be as follows:
 - .1 Color: white, with a reflectance of at least 85%.
 - .2 Color stability: yellowness index of no more than 0.02 from the original, and of no more than 0.05 after an exposure of 250 hours in an apparatus for accelerated aging "Atlas Fade-Ometer".

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- .3 Thickness of paint film: average of at least 0.03mm, and in no circumstances less than 0.025mm.
 - .4 Gloss: at least 80 units, measured at 60° with glossmeter Gardner.
 - .5 Flexibility: the coating shall withstand a bend test around a mandrel of 12mm and show no signs of cracking and flaking when it is observed under a microscope at a magnification of 10.
 - .6 Adherence: a grid of 24mm, composed of squares of 3mm, is traced by a sharp razor blade embedded in the paint film to the metallic substrate, a cellulose tape is then applied on the grid, then taken off: adherence is considered satisfactory if the pain coat does not peel off.
- .4 Alzak finish:
- .1 Type of finish obtained on an aluminum sheet made of special alloys, chemically polished then anodized according to Alcoa's specifications in a way to present, as required, the following characteristics:
 - .1 Type of finish designed for a light commercial service: coating having a surface weight of at least 7.8 g/m², reflectance of at least 83% in the case of specular surfaces, 80.5% in the case of semi-specular surfaces and 75% in the case of diffuse surfaces.
 - .2 Type of finish designed for a normal industrial service: coating having a surface weight of at least 14.8g/m²; reflectance of at least 82% in the case of specular surfaces and of at least 73% in the case of diffuse surfaces.
 - .3 Type of finish designed for a heavy service: coating having a surface weight of at least 21.8 g/m², reflectance of at least 85% in the case of specular surfaces, and of at least 65% in the case of diffuse surfaces.

2.4 OPTICAL CONTROL DEVICES .1 Optical control devices shall be built with noncombustible material such as acrylic (material derived from styrene polymer are not accepted).

2.5 CUTTING DEVICES .1 Fluorescent lamp lights shall be composed of:

- .1 A cutting device integrated to the lights.
- .2 Prominent and permanent identification specifying the use of cutting device and nominal voltage of lights.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Mounting heights as specified in drawings or determined by the Department's Designated Representative of architect on site.

.2 Install lights only when all work susceptible to damage or dirty them is done. The contractor shall obtain the engineer's approval before proceeding to the installation.

.3 The exact lights location shall be coordinated with the Department's Designated Representative and architect.

.4 In locations where there is piping in the ceiling or ventilation ducts, install lights on rods of appropriate length so that the light beam is not obstructed by piping.

.5 Aluminum lights in direct contact with concrete shall be coated with tar to contact points. Those installed outside shall be in "anodized aluminum" or in stainless steel.

.6 Install lighting devices and supports and/or poles according to specifications:

- .1 Lights shall be adequately supported for all type of ceiling systems in which they are mounted.
- .2 Install control equipment according to specifications.
- .3 Install exterior projector respecting manufacturer's

instructions. According to specifications and in the presence of the Engineer, in periods of darkness, orientate turned-on projector and fix then in permanent locked position.

- .7 At the Department's Designated Representative's request, before ordering lighting devices, the contractor shall provide and install on site un sample of each device and obtain Department's Designated Representative's approval.

3.2 WIRING

- .1 Connect lights to lighting circuits:
- .1 Install rigid conduit in rooms without ceilings or flexible in other cases, as indicated in sections 26 05 34 – Conduits, conduit fastenings and conduit fittings and 26 05 21 – Wires and cables.

3.3 ANCHORS AND SUSPENSIONS OF FLUORESCENT LIGHTS

- .1 Fluorescent lights installed directly on surface under concrete slabs are retained by bolts with self-drilling casing of 13mm.
- .2 Fluorescent lights are suspended from ceiling using suspension rods.
- .3 Spacing between support rods shall be according to manufacturer's recommendations.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.5 TESTS

- .1 Make tests according to section 26 05 00 – Common work results for electrical.
- .2 Ensure the good working conditions of all equipment.

PART 1 – GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA) / CSA International:
- .1 CSA C22.2 No. 141, Unit Equipment for Emergency Lighting.
- 1.2 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Place all packing materials, paper, plastic, styrofoam and corrugated cardboard into appropriate bins installed on site for recycling, according to plan waste management.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Department's Designated Representative
- .5 Fold the strip of metal banding, flatten, and place them in designated areas for recycling.
- 1.3 DRAWINGS AND TECHNICAL WORKSHOP .1 Submit shop drawings and specifications in accordance with sections 26 05 00 – Common Work Results for Electrical and 01 33 00 – Submittal Procedures.
- .2 The shop drawings must indicate the components' details, the installation method, the power source and special accessories.
- 1.4 WARRANTY .1 Provide a written warranty, signed, and issued on behalf of the owner, stating that the batteries for emergency lighting system are guaranteed against defective materials or workmanship for a period of 10 years. The replacement of the batteries will be made without any costs to the owner during the first five years, and with costs prorated over the next five years. This warranty is effective on the date of provisional acceptance of work.
- 1.5 DELIVERY .1 Unless they are not hermetically sealed, deliver the batteries dry.

PART 2 – PRODUCTS2.1 MATERIAL

- .1 Voltage 120V a.c.
- .2 Output Voltage: 24V DC as indicated.
- .3 Running time: 2 hours fully automatic.
- .4 Batteries: lead acid sealed, maintenance free, which is the expected longevity of 10 years.
- .5 Charger: semiconductors, plans to charge multiple controlled voltage / current, temperature-compensated hand, to protect against short circuits, regulated output voltage with an accuracy of ± 0.01 V for a variation of 10% of the input voltage.
- .6 Circuit switching semi conductors.
- .7 Integrated circuit specially designed for self-monitoring of all functions of the device.
- .8 Switch low voltage solid state, modular, working at 80% of the batteries voltage output.
- .9 Batteries protection by automatic low voltage circuit breaker.
- .10 Circuit protection in case of power surge.
- .11 15 minutes TIMER relay.
- .12 Discharge cycles, integrated circuit programmed, to ensure the optimal emergency lighting and life span of the batteries.
- .13 Circuit locking power a.c.
- .14 Dual color LEDs warning lights: semiconductor, life of 100,000 hours at least, and giving information "AC Power" and "Quick charge".
- .15 LEDs distinct fault indications: fault batteries, charger of lamps.
- .16 Test button to perform a 5 minute test of the unit.
- .17 Lamps: mounted on the emergency-light housing or mounted remotely as directed, 360 degrees horizontally and 180 degrees vertically adjustable, equipped with Tungsten halogen lamps for 36 to optical or lamps HRM.

EMERGENCY LIGHTNING

- .18 Housing: can be mounted directly on the wall or on a shelf and having knockouts to accommodate the connection of pipes with a removable front panel or hinged for easy access to batteries.
- .19 Finish: Beige or as directed by the architect.
- .20 Accessories:
 - .1 Power AC and DC output; terminal pads placed inside the housing.
 - .2 Shelf mounting.
 - .3 Cord and plug that can provide connection to AC.
 - .4 Suppression device.
- .21 Accepted Products: Emergi-Lite Series ESL, or Lithonia Lumacell.

PART 3 – EXECUTION**3.1 INSTALLATION**

- .1 Install emergency lighting in accordance with CSA C22.
- .2 Orient projectors as indicated.
- .3 Cut the cord to desired length and replace the plug.
- .4 Install an electrical outlet to 2200 mm from the floor near the unit for connection.
- .5 Check the operation of the self diagnosis system.