

**COMMON WORK RESULTS FOR
ELECTRICAL****PART 1 GENERAL****1.1 REFERENCES**

- .1 Definitions:
 - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Reference Standards:
 - .1 CSA Group
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2
 - .3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review electrical isolation plan identifying areas of the building and phasing of electrical isolations to provide for safe disconnection and removal of all electrically powered equipment and devices within the facility.
- .4 Certificates:
 - .1 Provide CSA certified equipment and material.
 - .2 Permits and fees: in accordance with Section 01 00 10 – General Instructions.
- .5 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 80% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 In accordance with general conditions and notes on drawings, provide record of disposal for all PCB containing materials including ballasts and transformers.

**COMMON WORK RESULTS FOR
ELECTRICAL****1.4 CASH ALLOWANCES**

- .1 Refer to Section 01 00 10 – General Instructions for cash allowances carried under this contract.

1.5 DEMOLITION**.1 General**

- .1 Entire facility is to be electrically isolated from the existing supply feed to permit removal of all equipment in a safe and orderly manner.
- .2 Provide temporary generator as required to supply power to existing power distribution equipment used for construction purposes when main power from Central Heating Plant is disconnected. Coordinate timing and installation with general trades.
- .3 Coordinate requirements with other trades to isolate equipment to permit removals.
- .4 All existing electrical equipment and devices are to be completely disconnected and removed including all associated conduit, wiring, enclosures, etc.
- .5 Isolate systems for removal in accordance with Health and Safety requirements.
- .6 Confirm equipment has been de-energized and isolated for removal by other trades.
- .7 Provide clear indication where systems have been isolated and where systems remain energized to prevent accidental contact with energized systems.

.2 Mechanical Equipment

- .1 For all mechanical equipment in the facility:
 - .1 Isolate service to mechanical equipment at source and lock off.
 - .2 Equipment will be isolated from and locked off either at the source panel or further upstream.
 - .3 As upstream panels are isolated and locked out, downstream sources can be clearly identified as de-energized and locks removed.
 - .4 Test and confirm isolation at equipment.

.3 Telecommunications Infrastructure

- .1 Completely remove and dispose of all remaining components of the telecommunications system including but not limited to equipment, cabling, conduit, service jacks, cable tray, racking, etc.
- .2 All material from the service entry through to the utilization points in the facility are to be removed.

.4 Branch Devices and Connected Equipment

- .1 Isolate service to rooms/devices and lock off at source panel or at distribution panel upstream.
- .2 As upstream panels are isolated and locked out, downstream sources can be clearly identified as de-energized and locks removed.
- .3 Test and confirm isolation at equipment.
- .4 Electrical contractor shall confirm through testing that equipment is de-energized.

.5 Lighting

- .1 Isolate, disconnect and remove light fixtures.
- .2 Fixtures original to the facility will have to be evaluated for PCB ballasts by

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- opening fixtures and comparing ballasts.
- .3 Recycle lamps with appropriate recycling facility and provide record documentation.
- .4 Dispose of any PCB Ballasts in accordance with regulations and provide record documentation.
- .6 Exterior Lighting
 - .1 Disconnect and remove existing underground supply feed.
 - .2 Disconnect and remove building and canopy mounted fixtures as indicated on drawings.
- .7 Electrical Distribution equipment (Switchboards, Panelboards, splitters)
 - .1 Isolate equipment in order to permit phased demolition. One (1) existing panel board per floor may be retained for use to power construction tools and equipment. Isolate and remove panel board when no longer needed.
 - .2 Isolate panels supplying isolated circuits to permit removal.
 - .3 Remove branch wiring/conduit and all associated material.
 - .4 Remove panels and separate waste and recyclable materials in line with waste management mandate.
- .8 Distribution Transformers
 - .1 Isolate transformer at source and lock out.
 - .2 Remove all associated wiring and conduit.
 - .3 Separate waste and recyclable materials in line with waste management mandate.
- .9 Power Transformers
 - .1 Isolate and lock out transformers at building's main switchgear.
 - .2 Drain transformers and handle oil in accordance with prescribed PCB handling procedures.
 - .3 Remove transformers from site and separate waste and recyclable materials in line with waste management mandate.
- .10 HV Feeders
 - .1 Arrange with Hydro Ottawa to isolate Insurance Building at the high voltage (5kV) breaker in Central Heating Plant and lock out and to remove cables #9 and #5 from Insurance Building switchgear #1 to manhole G5.
 - .2 Arrange with Hydro Ottawa to introduce splice in HV cable #5 in manhole G5 to reinstate power supply to Building 'B'.
 - .3 Remove cable duct bank and cap and seal entries into manhole.
- .11 Service Tunnel
 - .1 Trace circuits for any equipment with unknown sources.
 - .2 Isolate sources and pull all conduit and wiring back to the main tunnel in nearest junction box.
 - .3 Ensure remaining tunnel services are unaffected by removals.

**COMMON WORK RESULTS FOR
ELECTRICAL****PART 2 PRODUCTS****2.1 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.

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. Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Departmental Representative. Clearly identify systems and equipment which are energized and not suitable for removal/demolition.

2.4 WIRING TERMINATIONS

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

2.5 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue

**COMMON WORK RESULTS FOR
ELECTRICAL****PART 3 EXECUTION****3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install cables, conduits and fittings close to building structure to minimize impact on usable space within the ceiling cavity.

3.4 FIELD QUALITY CONTROL

- .1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 MV cabling and splices to be tested in accordance with drawing notes.
 - .2 Lighting and its control.
 - .3 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Check resistance to ground before energizing.

- .2 Carry out tests in presence of Departmental Representative.

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

3.5 CLEANING

- .1 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 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.

PART 2 PRODUCTS**2.1 TECK 90 CABLE (0 – 1000V)**

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride.
- .7 Fastenings:
 - .1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1500mm centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

WIRES AND CABLES (0-1000 V)**2.2 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Connectors: anti short connectors.

2.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local Authority Having Jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

2.4 GENERAL CABLE INSTALLATION

- .1 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .3 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

2.5 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps and hangers.

2.6 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.

PART 3 EXECUTION**3.1 NOT USED**

- .1 Not used.

**MOULDED CASE CIRCUIT
BREAKERS****PART 1 GENERAL**

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2 No. 5-13, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE-2013).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 100 A and over and with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.
- .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 Reduction Workplan.
- .3 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Reduction Workplan.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, and Accessory high-fault protectors: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.

**MOULDED CASE CIRCUIT
BREAKERS**

- .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 to have minimum 22 kA symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS

- .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.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Install circuit breakers in existing panel boards as required. New breakers to match existing and be compatible with existing panel boards.