

1 General

1.1 REFERENCE STANDARDS

- .1 Not Applicable

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Not Applicable

1.4 OPERATION AND MAINTENANCE DATA

- .1 Division 01, General Instructions, is a part of this Section and shall apply as if repeated here.
- .2 This Section 26 05 00 shall apply to and govern the Work of all Sections of this Division 26 Specification.

2 Products

2.1 MATERIALS

- .1 The specification complements the drawings in describing the supply and installation of a complete electrical system. This system shall include but not necessarily be limited to the following:
 - .1 Small power system including wiring devices;
 - .2 Lighting system including luminaries, including wiring;

3 Execution

3.1 INSTALLATION

- .1 The specification together with the drawings are intended to provide a description of a complete electrical system and therefore there shall be no omission of the items necessary or required to make a finished, workmanlike, first class installation, even though each and every item of labour and material may not be mentioned in the specification or shown on the drawings.
- .2 Items indicated on floor plans and not on riser diagrams, or vice versa, shall be considered fully covered by both.
- .3 Runs of conduit and outlet locations indicated on the drawings are diagrammatic and exact locations must be determined by this contract as the work proceeds, with due regard to the structure and the work of other trades. This contract shall make any changes dictated by structural requirements, or conflicts with other trades, without charge.
- .4 Apparent errors or omissions shall be referred to the Architect/Engineer whose decision shall be final.
- .5 Building dimensions shall not be scaled from the electrical drawings but shall be obtained from the architectural and/or structural drawings. Any discrepancy between the drawings and building shall be questioned before proceeding with the installation.

3.2 CODES AND STANDARDS

- .1 As a minimum standard perform all work in accordance with the requirements of the Provincial Department of Labour, Canadian Electrical Code C22.1-2009 Part 1, CSA Standards CAN Z32.4 and CAN Z32.2, National Building Code, and ULC-S524-1978. These standards together with all local or municipal rules, regulations, and ordinances shall be considered as the latest approved editions at the time of tender closing. In no instance, shall the standard established in these

- contract documents, be reduced by any codes.
- .2 Do underground systems in accordance with CSA CAN-C22.3 No. 7-94.
- .3 Abbreviations for electrical terms: to CSA Z85-1983.

3.3 INSPECTIONS, PERMITS AND FEES

- .1 Obtain all inspections and permits required by all laws, ordinances, rules and regulations by the public authority having jurisdiction at the place of this building for work of Contract 10, and obtain certificates of such inspections and submit same and pay all charges in connection therewith. The final certificate of inspection shall be obtained before final payment for work shall be considered due.

3.4 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples in accordance with Section 01 33 00. Provide all shop drawings within 30 days after contract has been awarded. Failure to do so will delay progress payments.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .5 Keep one copy of shop drawings and product data on site, available for reference at all times.

3.5 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manuals as specified in Section 01 78 00.
- .2 Include in the operation and maintenance data:
 - .1 Details of design elements, construction features, component function, and maintenance requirements to permit effective start up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical description of items and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.
 - .5 Copy of reviewed shop drawings.
 - .6 Signed receipt for all spare parts.
- .3 Approvals:
 - .1 Submit one draft of Operating and Maintenance Manual to Engineer for approval one month prior to estimated substantial completion date. Submission of individual data will not be accepted unless so directed by Engineer.
 - .2 Make any changes in submission as may be required and re-submit as directed.
 - .3 Failure to do so will result in delay of progress payment.
 - .4 Provide two (2) final bound copies of Operation and Maintenance Manuals to Owner and one (1) bound copy to Engineer.

3.6 PROJECT RECORD DOCUMENTS

- .1 Provide Project Record Documents in accordance with Section 01 78 00.
- .2 Submit record drawings to Architect/Engineer showing changes of wire sizes, circuit numbering and location of raceways, fittings, fixtures, panels and equipment, and their sizes, the location of which has changed or deviated during the work.
- .3 Submit sepia or reproducible of record drawings after record drawings have been approved by the

Engineer. Originals shall be made available by the Engineer for the making of sepia or reproducible of the contract drawings. All changes reflected on record drawings are to be indicated on these sepia or reproducible.

3.7 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00.

3.8 CARE, OPERATION AND START UP

- .1 Instruct operating personnel in the operation, care and maintenance of the equipment.
- .2 Arrange and pay for services of the manufacturer's service engineer to supervise start-up and to check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.9 VOLTAGE RATINGS

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

3.10 MATERIALS AND EQUIPMENT

- .1 Equipment and materials to be C.S.A. certified, and manufactured to standard quoted.
- .2 Where there is no alternative to supplying equipment which is not C.S.A. certified, obtain special approval from C.S.A.
- .3 Factory assemble control panels and component assemblies.
- .4 For the purposes of uniformity similar materials shall be of one manufacturer (i.e. all panels; all motor control equipment; all fixtures in as much as is possible, etc.).
- .5 To avoid the possibility of the work being delayed, order all materials as soon as the shop drawings are reviewed, and report at once to the Architect/Engineer any delays in the delivery of materials which would hold up the completion of the job.

3.11 GROUNDING

- .1 All equipment and exposed non-current carrying metal, conduits and parts shall be permanently and effectively grounded to meet minimum requirements of the C.E.C. Section 10, and as indicated on the drawings and further specified. Standards set either by drawings or specifications which are above those covered by C.E.C. Section 10, shall not be reduced under any circumstances.

3.12 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Provide final connections to all motors, equipment, controls, etc., indicated on the drawings. These motors, equipment, controls, etc., shall include those supplied under other sections of this specification, as well as Owner supplied items. Ensure that equipment will operate properly (e.g. proper rotation) and report any instance of defective equipment to the Architect/Engineer.
- .2 Supplier and installer responsibility is indicated on electrical drawings, and in this specification and related mechanical responsibility is indicated on mechanical drawings, and in the Division 23 specifications.
- .3 All electrical equipment, which is supplied and installed by this Contract or other contracts, that requires wiring at or above 50V, shall be wired by this Contract in accordance with terms and regulations established by this Specification.

- .4 All electrical wiring and connections below 50V related to systems specified under other sections or contracts shall be done by their contractor in accordance with terms and regulations established by this Specification.
- .5 All electrical wiring and connections below 50V related to systems specified by Division 26 shall be done by the Division 26 Contractor.

3.13 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment, "Equipment Green" finish to EEMAC Y1-1-1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime and paint exposed hangers, racks, and fastenings to prevent rusting.

3.14 EQUIPMENT IDENTIFICATION

- .1 All switchboards, motor control centres, disconnect switches, dry-type transformers starters, pushbuttons, panels, etc., shall have "Lamacoid" nameplates mounted on or adjacent for identification which shall include the panel designation, voltage, phase, wires overcurrent protection, H.P., KW and amperage as applicable. The nameplates shall be affixed to equipment with permanent adhesive backing.
- .2 Install directories on the back of each door of panel boards, neatly arranged and mounted in frame under transparent cover. Directories shall be typed and shall show system voltage, which outlets are on each circuit and any special information, such as sizes of fuses, etc., necessary for the proper operation and maintenance of the system.
- .3 All sectionalising panels shall have lamacoid plates affixed adjacent to each breaker.
- .4 Size of identification shall be suitable for equipment and importance of information.
- .5 All fused disconnect switches shall have lamacoid plates identifying the equipment they feed and a separate plate indicating maximum fuse size and type.
- .6 Lettering shall be of sufficient size to be readable from normal viewing distance and the information required on the nameplates shall dictate the physical size of plates.
- .7 Nameplates shall have white lettering on black background except for equipment connection to emergency power source, which shall have white lettering on red background.
- .8 All transformers to have lamacoid plates identifying source of primary feeder and secondary equipment which it feeds plus distribution designation lettering and/or numbers.
- .9 All "D" and "E" boxes 200 x 200 x 100" or larger and "C" and "T" cabinets shall have lamacoid plates affixed indicating voltages and/or systems housed within.
- .10 Nameplates:
 - .1 Lamicoid " thick plastic engraving sheet.

.1	Size 1 10mm x 50mm	1 line	high letters
.2	Size 2 13mm x 69mm	1 line	high letters
.3	Size 3 13mm x 69mm	2 lines	high letters
.4	Size 4 19mm x 91mm	1 line	high letters
.5	Size 5 19mm x 91mm	2 lines	high letters
.6	Size 6 25mm x 100mm	1 line	high letters
.7	Size 7 25mm x 100mm	2 lines	high letters
- .11 Labels:
 - .1 Embossed plastic labels with 6.5mm high letters unless specified otherwise.
- .12 Wording on nameplates and labels to be approved by the Engineer prior to manufacture.
- .13 Allow for average of twenty-five (25) letters per nameplate and label.
- .14 Identification to be English.

3.15 WIRING IDENTIFICATION

- .1 Identify wiring with coloured plastic tapes, label to include panel and circuit number. Label to be on each conductor at both ends.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code to meet requirements of CSA C22.1-2009
- .4 Use color coded wires in branch circuit wiring, systems wiring and communication cables.

3.16 CONDUIT AND CABLE IDENTIFICATION

- .1 Identify conduit and metallic sheathed cable runs for the various systems with 25mm coloured bands placed on conduit run every 3 metres of length and at least one should appear in each room and at points where conduit or cable enters wall, ceiling or floor.
- .2

System	Colour
.1 120/208V Lighting & Power	Yellow
.2 Telephone	Black
.3 Grounding	Green
.4 Fire Alarm	Red

3.17 WIRING TERMINATIONS

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

3.18 MANUFACTURERS AND CSA LABELS

- .1 Manufacturers and CSA labels shall be visible and legible after equipment is installed.

3.19 WARNING SIGNS

- .1 Provide warning signs, as specified and/or to meet the requirements of the Department of Labour Inspection Department.
- .2 Use decal signs, minimum 175mm x 250mm size.

3.20 SINGLE LINE ELECTRICAL DIAGRAMS

- .1 Provide a single line diagram of the fire alarm system under plexiglass at the fire alarm panel and/or annunciator.

3.21 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 27 26.
- .2 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit providing distance does not exceed 3 metres and information is given before installation.
- .4 Locate light switches on latch side of doors and safety switches in mechanical rooms on latch side of door where possible.
- .5 Coordinate on site the location of outlets with respect to counters, heating cabinets, etc., before work is to start.

3.22 MOUNTING HEIGHTS

- .1 Mounting heights of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise.
 - .1 Local switches, to switch: 1200mm
 - .2 Wall receptacles:

.1	General:	400mm
.2	Above top of continuous baseboard heater:	200mm
.3	Above top of counters or splash back:	375mm
.4	In mechanical rooms:	1200mm
.3	Panel boards: as required by code or as indicated	
.4	Data/Telephone outlets:	400mm
.5	Pay phone:	1200mm
.6	End of line resistor:	2100mm
.7	Motor starters, disconnect, etc.:	1500mm
.8	Luminaries: as indicated on drawings	
.9	Fire alarm pull stations:	1200mm
.10	Fire alarm bells:	2100mm
.11	Unit emergency lighting equipment:	2100mm

3.23 PROTECTION

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

3.24 LOAD BALANCE

- .1 Balance all phase currents of transformers, main switchboard, distribution Panel boards, etc., and where applicable, adjust transformer taps to obtain within 2% of the rated voltage of the load being supplied. Make adjustments and/or increase conductor size so as to limit voltage drops to 3% and make such adjustments under average load conditions in presence of Engineer.
- .2 Submit to Engineer, at completion of work, a report listing the voltage, phase and neutral currents on the switchboard, Panel boards and dry-type transformers, operating under normal load. On the report also state hour and date on which each load was measured.

3.25 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete shall be constructed of sheet metal, sized for free passage of conduit, and protruding 50mm.
- .2 Install cables, conduits, and fittings to be embedded neatly and close to building structure so furring can be kept to minimum.

3.26 FIRE STOPPING AND SMOKE SEALS

- .1 All fire stopping and smoke seals required specifically for the work of this Contract shall be the financial responsibility and carried out by the Division 26 Contractor. Fire Stop to be 3M CP25 Caulk or approved equal.

3.27 TESTS

- .1 Conduct and pay for tests of the following:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors and associated control equipment including sequenced operation of systems where applicable.
 - .5 All Miscellaneous Systems.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturers instructions.
- .3 Carry out tests in presence of Architect and/or Engineer. Notify Architect and/or Engineer seven (7) days in advance of time testing will take place.

- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 The Architect and/or Engineer reserves the right to use any piece of electrical equipment, device, or material installed under this contract for such reasonable lengths of time and at such times as he may require to make a complete and thorough test of the same, before the final completion and acceptance of the work.
- .6 Such tests shall not be construed as acceptance of any part of the work.
- .7 Submit test results for Architect's and/or Engineer's review.

3.28 INSULATION RESISTANCE TESTING

- .1 Test all wiring, included in the work to ensure that there are no shorts and/or grounds are present on phase conductors for feeders or branch circuits and that insulation values are as required by the Canadian Electrical Code.
- .2 All testing of conductors to be done prior to energization of conductors with 600 volt and 1000 volt meggers as required by the Canadian Electrical Code.
- .3 Capacitive leakage testing of all phases and neutral feeder conductors at various systems originating points, are to be recorded for each individual feeder with test results to be submitted to Architect and/or Engineer for approval.
- .4 Systems to be tested for capacitive leakage are as follows: 120/208V/3PH/4W.
- .5 Check resistance to ground before energizing. Ensure resistance to ground is not less than 50 megohms.
- .6 Submit test results for Architect's and/or Engineer's review. Test results shall include time of test, feeder tested, and instrument readings.

3.29 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as over-current trips, relays, fuses, are installed to values and settings as indicated.

3.30 CLEANING

- .1 Do final cleaning in accordance with Section 01 74 11.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 On completion of work, remove debris resulting from work of this Division and leave the site neat and tidy. Equipment shall be checked for proper fitting and alignment, adjusted, cleaned, repainted where necessary, and left in first class condition.
- .4 This section shall be responsible for the removal of spatters, droppings, soil, labels, and debris from finished surfaces and from surfaces to receive finishes, before the set up. Work and adjacent finished work shall be left in new condition.
- .5 Only cleaning materials which are recommended for the purpose by both the manufacturer of the surface to be cleaned and of the cleaning material shall be used.
- .6 Immediately before and during finishing work shall be made "broom clean". Interior areas shall be "vacuum cleaned" immediately before finish painting commences.
- .7 Material at site cannot be burned or buried except where approved by Architect and/or Engineer. Removal shall be as often as required to avoid accumulation in order to ensure site is maintained clean.
- .8 Volatile fluid wastes cannot be disposed of in storm or sanitary sewers or in open drain courses.
- .9 Lowering of materials shall be controlled and shall not be dropped or thrown from stories above grade.

3.31 COORDINATION

- .1 Cooperate and investigate with other trades to make maximum use of the spaces. Avoid conflicts with pipes, ducts, etc. Prepare shop drawings indicating the route of main conduits and ducts for submission to the Architect and/or Engineer for approval.
- .2 Cooperate with other trades on the site and carry out the work, in such a way, as not to hinder or hold up the work of other trades.
- .3 Consult with other trades, where their respective installations conflict and re-route conduits, ducts, outlets, equipment, etc., as required, subject to the approval of the Architect and/or Engineer.
- .4 Obtain from the mechanical and other trades complete detailed wiring diagrams of equipment requiring connections and be responsible for pointing out any discrepancies or the reason why they cannot be adhered to.
- .5 Locate all light fixtures, speakers, smoke detectors, etc. using Architect's reflected ceiling plan as a guide.

3.32 SUPERVISION

- .1 Provide supervision and sufficiently qualified foreman for work of this Contract to ensure that the work proceeds in proper and efficient manner to its completion. If in the opinion of the Architect and or Engineer, such personnel are not competent to carry out the work, replace these men immediately upon written request of the Architect and/or Engineer.

3.33 COMMISSIONING OF ELECTRICAL SYSTEMS

- .1 Upon receipt of written verification from the Contractor that:
 - .1 All systems are complete and operational in all respects.
 - .2 All specified reports and documents have been submitted and approved.
 - .3 All demonstrations have been completed and documented, the Engineer will commence a systems' commissioning period.
- .2 During this period of not more than 20 working days, the Engineer will verify the operation of all systems. The commissioning process may involve real or simulated conditions to determine the systems full operational capabilities. Copies of all specified reports and documents are to be available on site during the commissioning period.
- .3 During the commissioning process, the on-site foreman of the electrical subtrade involved in the supervision of the work plus one electrician is to be on site providing full-time assistance to the Engineer. In addition, systems' suppliers' representatives are to be available to be on site providing full-time assistance to the Engineer within 48 hour's notice to assist in the verification of their respective systems.
- .4 All necessary equipment such as meters, load banks, et cetera required to fully commission the systems are to be made available to the Engineer.
- .5 Deficiencies or discrepancies discovered during the commissioning process are to be immediately rectified. Exceptional arrangements for labour and materials will be required to correct deficiencies, which prevent the satisfactory completion of the commissioning process.

3.34 ELECTRICAL ROOM LAYOUTS

- .1 Not Applicable

3.35 ACCESS DOORS

- .1 Not Applicable

3.36 UTILITY SERVICES

- .1 Not Applicable.

3.37 BREAKDOWN OF COSTS

- .1 Division 26 Contractor shall have 10 days after award of contract to provide a cost breakdown for the progress claims as follows:
- .2 ELECTRICAL
 - .1 Light fixtures and wiring
 - .2 Miscellaneous Systems

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 38 - Thermoset insulated Wires and Cables.
- .2 CSA C22.2 No. 51 - Armoured cables.
- .3 Wire and cable shall conform to the latest specification of the Canadian Standards Association (CSA), Electrical and Electronic Manufacturers Association of Canada (EEMAC), the Insulated Power Cable Engineers Association (IPCEA), and the American Society of Testing Materials (ASTM).

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 BUILDING WIRES

- .1 Conductors: Copper, soft drawn stranded, at least 98% conductivity for #10 AWG and larger. Insulation shall be chemically cross-linked thermosetting polyethylene rated 600 volts on all RW90 conductors and 1000 volts for RWU-90 for incoming service. Size as indicated on drawings and schedules. Conductor insulation shall be colour coded as follows:
 - .2 Phase A - Red
 - .3 Phase B - Black
 - .4 Phase C - Blue
 - .5 Neutral - White
 - .6 Ground - Green
 - .7 Isolated Power - as indicated hereinafter.
 - .8 Where extra colours are required for three-way switches, etc., they shall be yellow.
 - .9 Approved color coded tape is acceptable for color coding phase conductors #1 AWG and larger and for neutral and ground conductors #4/0 and larger.

2.2 CONTROL CABLES

- .1 600 V Type: 2 stranded copper conductors, 95% conductivity, full size AWG gauge, sizes as indicated with PVC insulation Type TW with shielding of magnetic tape wire braid over each pair of conductors and overall covering of thermoplastic jacket. Colour code shall be orange and brown.

2.3 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: to manufacturer's recommendations.

2.4 TECK CABLE

- .1 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .2 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated 600 volts on all RW90 conductors and 1000 volts for RWU-90 for incoming service.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: aluminium
- .5 Include UV rated protective heat shrink for all exposed conductor tails.
- .6 Overall covering: polyvinyl chloride material, Firex II rating.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50mm and smaller. Two hole steel straps for cables larger than 50mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods to support suspended channels.
- .8 Connectors:
 - .1 Approved for teck cable and the environmental application:

2.5 SYSTEM WIRING

- .1 Wiring for auxiliary systems will be as indicated in specification or on drawings and/or as recommended by Manufacturer of the system.

2.6 MANUFACTURERS

- .1 Acceptable Material: Nexans or approved equal.

3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install all building wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 32.
- .2 Terminate wires in accordance with Section 26 05 00.

3.2 INSTALLATION OF CONTROL CABLES

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

3.3 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 17.
- .3 Flexible type conduit c/w RW90 conductors sized as noted and or flexible armoured cable AC90 (BX) complete with separate grounding conductor shall be used for all bench or counter wiring of receptacles or other devices.
- .4 AC90 cable is to be used for fixture drops, receptacle drops, and fixture switching unless otherwise noted on Drawings. Total length of any individual AC-90 cable or flex c/w RW90 runs not to exceed 4500mm in length.
- .5 These fixture drops to be run from the junction box in respective rooms and not run to fixtures in any other adjacent rooms.
- .6 All flex c/w RW90 or AC-90 cables used for fixture drops are to be secured within 300mm of the junction box.
- .7 Where application of AC-90 cables and/or other types of pliable cables are to be used, they shall

- be installed parallel or perpendicular to the building lines unless otherwise noted.
- .8 Support and securing of type AC-90 cables not to be derived from either suspended ceiling support wires or directly laying atop of the ceiling grid system.

3.4 INSTALLATION OF TECK CABLE

- .1 Install cables as indicated.
- .2 Group cables wherever possible on channels.
- .3 Terminate cables in accordance with Section 26 05 17.

3.5 INSTALLATION - GENERAL

- .1 Where pulling wires and cables, the use of an approved lubricant only will be permitted. No wires or cables shall be pulled in conduits until such conduits are free from moisture and in no case shall wires be pulled until approval of the Architect and/or Engineer is obtained.
- .2 All stranded conductors prior to terminating under device bolts such as circuit breakers, light switches, receptacles, etc., to be twisted together to form a single conductor to ensure a reliable mechanical connection.
- .3 "Labelling" of all branch circuit wiring including phase conductors, neutrals, ground and/or bonding conductors to be done on both ends of all circuit wires plus in any junction and/or pull boxes located in between using "Panduit" write-on, self laminating labels Nos. PDL-1 and PDL-2 as required.
- .4 The following wiring methods are designed to enhance the ability to perform capacitive leakage tests:
- .1 All circuit conductors are to be individually tie wrapped to their corresponding labelled neutral conductor in all panelboards, pullboxes and junction boxes. Enough slack conductor length should be left to enable the ability to clamp the ground detector around the individually tie-wrapped circuit conductor and its corresponding labelled neutral. This wiring method is to be neat and of good workmanship quality.
- .2 The tie wrapping of the neutral with its respective phase conductors is to be made at the closest point of entry into panelboards, pullboxes and junction boxes.
- .3 The main switchboard, CDP's, panelboards, MCC's etc, are to have their respective feeder phase and neutral conductors tie-wrapped together and enough slack conductor length to enable the ability to clamp the ground detector around each set of feeders. This wiring method is to be neat and of good workmanship quality.
- .4 After all electrical wiring has been completed by the Electrical Sub-Contractor, he is to test the grounded electrical distribution system to ensure there are not ground shorts and capacitive leakage in the system.
- .5 All feeders or branch circuits which do not have neutral conductors are to have their respective phase conductors tie-wrapped together in accordance to the methods described previously.
- .6 Run all circuits so that the voltage drop in no case exceeds 3% of the line volts. The neutral wire, wherever it is run, shall be continuous with no fuses, switches, or breaks of any kind.
- .7 For 15 amp, 120 volt circuits the following table shall be used to determine the minimum conductor sizes required to compensate for voltage drop.
- .8 Find below the branch circuit maximum lengths (120 volt one way length from panelboard to load including vertical drops. Do as to limit voltage drop to 3%.
- | | | | |
|----|------|-------------|----------|
| .1 | From | 0.3m to 24m | #12 Wire |
| .2 | From | 24m to 37m | #10 Wire |
| .3 | From | 37m to 55m | #8 Wire |
- .9 Increased wire sizes where required shall not be decreased in size in any portion of length

- .10 of run between panelboard and the wiring device itself.
All wire shall be color coded as per Code requirements and/or as specified herein.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 18 - Clamps and connectors.
- .2 CSA C22.2 No. 65 Wire Connectors.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Not Applicable

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 MATERIALS

- .1 All connections shall be made electrically and mechanically secure. Sizes of connectors shall be according to manufacturer's recommendations for each size and combination of wires.
- .2 Joints required in branch wiring #10 AWG and smaller shall be made using fixture twist-on type connectors with current carrying parts made of copper.
 - .1 Standard of Acceptance: Marrette #31, #33 or #35 as required.
- .3 Joints for wiring #8 AWG and larger shall be made using pressure type colour keyed compression connectors with current carrying parts made of copper using compression tools. A first layer of tape shall be compound type followed by a layer of Scotch #3 vinyl type.
 - .1 Standard of Acceptance: 54000 series.
- .4 Bushing stud connectors: As required to suit conductors.
- .5 Clamps or connectors for armoured cable and flexible conduit as required.

3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
- .2 All connections shall be made electrically and mechanically secure. Sizes of connectors shall be according to manufacturer's recommendations for each wire size and combination of wires. Twist wires together before installing connectors. All stranded conductors shall be twisted together prior to connection around terminal.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 41 - Grounding and Bonding Equipment.

1.2 RELATED WORK

- .1 Electrical General Instructions: Section 26 05 00
- .2 Wires and Cables, 0 to 1000V: Section 26 05 16

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Not Applicable

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor, size as required to electrically conductive ground rods.
- .2 System and circuit, equipment, grounding conductors, bare stranded copper, un-tinned, soft annealed, un-armoured, size as indicated.
- .3 Insulated grounding conductors to Section 26 05 16.
- .4 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 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

2.2 MANUFACTURERS

- .1 Acceptable Material: Thomas & Betts.
- .2 Other approved manufacturers: Burndy, McGraw Edison.

3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Engineer, and local authority having jurisdiction over installation. Where EMT is used for panelboard or motor control board feeders, run a separate green ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to electrodes, using compression type connectors.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Connect building structural steel to ground by welding copper to the steel near service entrance.
- .11 Connect boiler stack, diesel generator stack and boiler blow-off stack to ground by wire braid.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to the neutral of the 120/208V systems as required.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, distribution panels, and outdoor lighting.

3.4 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Fire alarm, intercommunication systems as required.

3.5 TESTS

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Submit test results for Engineer's review.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 Not Applicable

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 SUPPORT DEVICES

- .1 U shape, size 41mm x 41mm, 2.5mm thick, surface mounted or suspended as required.
- .2 Supply and install all necessary inserts, rods, channels, brackets, etc., to form a support system capable of carrying at least twice the weight of the equipment supported.
- .3 In concrete, use cast-in threaded inserts wherever possible. Should additional inserts be required use a "red head" type of insert capable of carrying at least 45 kgs.
- .4 All hanger rods shall be 10mm diameter continuous threaded rod cut to required lengths.
- .5 All conduits not installed on unistrut or approved equal type support channels to be supported as follows:
 - .1 13mm up to and including 50mm conduits - one hole steel straps.
 - .2 50mm and larger sizes - two hole steel straps.
- .6 Beam clamps to secure conduit to exposed steel work.
- .7 All trays, wireways, and multiple conduits, shall be supported by a steel channel support system with all components, hangers, wall supports, cable clamps, etc., specifically manufactured and approved for their application.
- .8 Fastening devices for cabinets, boxes, supports, etc., shall be nut and bolt, ramset, expansion shields, wedge anchors, or toggle bolts, size and number to suit the application or as detailed on the drawings. Toggle bolts shall not be used in gypsum wallboard construction.
- .9 Fastening devices for outlet boxes shall be nut and bolt, ramset, expansion shields, wedge anchors or caddy clips, size and number to suit the application or as detailed on the drawings.

2.2 MANUFACTURERS

- .1 Acceptable Material: Burndy.
- .2 Other approved manufacturers: Erico, Electrovert, Pursley, Unistrut.

3 Execution

3.1 Installation

- .1 Secure equipment to hollow or solid masonry tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry wall, or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T-bars are adequately supported to carry weight of equipment specified before installation.

- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 10mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 10mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at 1.5m on center spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support 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 Engineer.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Coordinate the location of any insert to miss concrete reinforcement and obtain approval of Architect and/or Engineer prior to installing.
- .14 Secure all equipment in a manner, so as not to distort or cause undue stress on any components.
- .15 Support of any equipment shall not rely on the strength of plaster, or gypsum board construction.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CAN/CSA C22.2 No. 18 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .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 (Un-plasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3 Flexible Non-metallic Tubing.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND RELATED DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Drawings do not show all conduits. Those shown are in diagrammatic form only.

1.4 OPERATIONS AND MAINTENANCE DATA

- .1 Provide data for incorporation into maintenance manual specified in Section 01 78 00 and 26 05 00.

2 Products

2.1 CONDUITS

- .1 Thin wall type electrical metallic tubing "EMT" with steel set screw couplings, galvanized, size as indicated.

2.2 COUPLINGS AND CONNECTIONS

- .1 Couplings and connectors for thin wall type "EMT" shall be set screw type, galvanized steel. Locknuts shall be case hardened steel.
- .2 Connectors for flexible conduit and cable shall be set screw, galvanized steel. Locknuts shall be case hardened.

2.3 CONDUIT FASTENINGS

- .1 One-hole steel straps to secure surface conduits 50mm and smaller. Two hole steel straps for conduits larger than 50mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits spaced at 3 metres on centre.
- .4 Use 6.5mm diameter threaded rods to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating same as conduit.
- .2 Factory "ells" where 90°C bends are required for 25mm and larger conduits.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear

- expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene with a minimum of 6.5mm diameter and a tensile strength of 5kn.

2.7 MANUFACTURERS

- .1 Standard of Acceptance: Scepter

3 Execution

3.1 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 and in unfinished areas.
- .3 Bend conduit cold. Mechanically bend steel conduit over 19mm diameter. Replace conduit if kinked or flattened more than 1/10 of it's original diameter.
- .4 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .5 Install fish cord in empty conduits.
- .6 Run 2-25mm spare conduits up to ceiling space from each flush panel. Terminate these conduits in 150 x 150 x 150 mm junction boxes in ceiling space.
- .7 Galvanized rigid steel threaded conduit shall be used in all poured concrete construction, where subject to mechanical injury, as indicated, and where no conduit is specified. Thin wall type electrical metallic tubing "EMT" shall be used for all branch circuit wiring and all systems concealed in ceilings and wall unless otherwise noted. Do not use "EMT" where subject to mechanical injury in cast concrete or in wet areas. Code approved rigid PVC shall be used for underground wiring. Bends, offsets, or elbows made on the job for steel conduit shall be made so that the conduit is not injured or flattened.
- .8 Unless noted otherwise all branch circuits and feeders to panels, switchboard, motor control centres, etc., shall be run in EMT conduit, and in addition to phase and neutral conductors a separate green insulating bonding conductor is to be included in the feeder, and the size of the conduit is to be increased accordingly. The ground conductor shall be based on Table 16 of the Canadian Electrical Code.
- .9 All concealed and exposed conduit shall be kept parallel to building lines. All conduits shall be securely held in C.E.C. Section 12. All conduits shall be installed to avoid proximity to steam and hot water pipes by 150mm. Conduits shall run through ceiling spaces and down in walls. No conduit shall run in or under floor slabs unless specifically indicated and approved by Architect and/or Engineer.
- .10 Wire mold surface mounted raceway shall be used only where indicated.
- .11 Flexible conduit, not smaller than 10mm inside diameter, or flexible armoured cable AC90 (BX) with separate grounding conductor, and complete with insulating anti-shorts, shall be used for connection to motors in dry locations, recessed incandescent fixtures without a pre-wired outlet box, connections to surface or recessed fluorescent fixtures and where rigid or "EMT" conduit cannot be used, such as in cabinet work.
- .12 Use liquid tight L.T. flexible metallic conduit (T & B) not smaller than 10mm ID for connections to all motors and equipment in damp, or wet locations and where indicated. Adaptation to rigid or "EMT" conduit shall be made in an outlet box or fitting and a separate green insulated grounding conductor shall be included in the flexible conduit. Bonding conductor shall be sized in accordance with Table 16 of the Canadian Electrical Code, and the size of the flexible conduit increased accordingly.
- .13 Conduit stubs in concrete shall be protected from damage during construction. Conduit openings

shall be sealed with plugs or caps to prevent entrance of foreign materials. Where conduits pass through a waterproof membrane, an oversized sleeve shall be installed and caulking applied to maintain the waterproof properties of the membrane. A cold cure mastic shall then be applied between sleeve and conduit.

- .14 All conduit in concrete slabs passing through building control or expansion joints shall be fitted with approved expansion joints specifically designed and CSA approved for the purpose. Expansion joints for surface installed conduit up to and including 25mm conduit may be achieved by providing two 90 deg. bends (a minimum of) 450mm apart. All other expansion joints of sizes 32mm and larger are to be CSA approved.
- .15 Upon installation of all conduits, terminate in boxes, cabinets, and fittings or install suitable plugs or caps, to prevent the entrance of foreign materials. Conduit shall be dry before conductors are pulled in. Swab out using a drag, consisting of tight fitting rubber washers. Where conduits become blocked, remove and replace blocked section.
- .16 Placing reinforcing steel in concrete slabs shall take precedence over placing of conduits. Conduits shall not cross one another and where possible shall be spaced a minimum of 9" apart.
- .17 All conduit subject to corrosive elements shall be treated with corrosive resistant compounds.
- .18 Conduit shall not pass through structural members without the permission of the Architect and/or Engineer.
- .19 A sufficient number of pull boxes or other fittings shall be used to permit easy pulling of wires. Conduits shall be continuous, and shall be electrically and mechanically secure throughout.
- .20 All feeder conduit 25mm and larger where exposed to view and in spaces accessible for servicing shall be identified with 19mm coloured bands, placed on average every 3 metres length of conduit, and at least, one shall appear in each room. Colour coding shall be as for various system voltages and shall be as specified for pull and junction boxes.
- .21 Support of electrical system raceways are to be independent of any other type of suspended ceiling support rods, hangers, etc. and of all mechanical ductwork and piping systems.
- .22 "EMT" conduit shall be installed as a complete system and be securely supported in place within 1 metre of each outlet box, junction box, pull box, cabinets, fittings, etc. with spacing of supports not to exceed the following as per C.E.C. Rule 12-1010.
 - .1 1500mm for 16mm and 21mm conduits.
 - .2 2000mm for 27 mm and 35mm conduits.
 - .3 3000mm for 41mm and larger conduits.
- .23 Where factory installed internal isolating vibration pads are provided for dry core transformers, direct conduit connections to transformer enclosure will suffice.
- .24 Where factory isolation pads are not provided for dry core transformers, transition from rigid conduit to be provided via standard type flexible conduit.
- .25 Liquid tight flexible conduit to be used for the final connections to dry core transformers located in damp areas or as otherwise noted on electrical drawings.
- .26 For panel A, contractor to re-use the tub of the existing panel board that is located in this location. Remove the interior of the panel and replace with a new interior that will coordinate with the existing tub.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Run conduits in flanged portion of structural steel.
- .3 Group conduits wherever possible on surface channels.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75mm parallel to steam or hot water lines with a minimum of 25mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Not Applicable

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Not Applicable

3.6 CONDUITS UNDERGROUND

- .1 Not Applicable

3.7 COUPLINGS AND CONNECTORS

- .1 Threaded couplings shall be used for all rigid steel threaded conduit joints. All joints in or below concrete slabs shall be thoroughly red leaded and screwed tight. No exposed threads shall be left, i.e. running thread couplings are not approved. Ericson couplings are approved.
- .2 Rigid steel threaded conduit shall connect to boxes and cabinets with the use of two casehardened steel locknuts and insulated bushing. Painted area at locknut connections shall be scraped clean, and locknuts screwed tight to ensure ground continuity.
- .3 Thin wall type "EMT" couplings shall be securely tightened.
- .4 Connectors for thin wall type "EMT", liquid tight and flexible conduit or cable shall terminate at boxes and cabinets with one case hardened locknut. Painted area shall be scraped clean, and locknut screwed tight to ensure ground continuity.
- .5 Couplings and connectors for rigid PVC shall be cleaned with solvent and joined with cement approved by CSA for the purpose.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 18 - Outlet boxes, conduit boxes and fittings.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PROJECT DATA

- .1 Not Applicable

1.4 OPERATION AND MAINTENANCE MANUAL

- .1 Not Applicable

2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with Canadian Electrical Code, Part 1.
- .2 100mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with CSA approved barriers where outlets for more than one system are grouped.
- .6 Outlet boxes for concealed use in frame construction shall be sectional, galvanized, pressed steel; these shall be restricted for use with flexible conduit AC-90 cable (where indicated) or other pliable type cable. The installation of any type of rigid type conduit in sectional boxes is prohibited. Where wire fill dictates larger boxes for outlets, use suitably sized square boxes, with raised "tile ring" style extension.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 x 50 x 63mm or as indicated.
 - .1 Standard of Acceptance: Commander 1104 Series. 100mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 100 x 63 x 50mm.
 - .1 Standard of Acceptance: Commander 1110 Series.
- .3 100 mm square or octagonal outlet boxes for lighting fixtures.
 - .1 Standard of Acceptance: Commander 22171 and 24171 Series.
- .4 100mm square outlet boxes with extension and plaster rings for flush mounting special devices in finished plaster or tile walls.
 - .1 Standard of Acceptance: Commander 22171 Series.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry boxes single and multi gang for devices flush mounted in exposed block walls.
 - .1 Standard of Acceptance: Commander "M85" & "M80" Series.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete boxes for flush mounting in concrete with matching extension and plaster rings as required.
- .2 Where wire fill dictates larger boxes than single gang outlets, use suitable sized square boxes, with raised "tile ring" style extension.

2.5 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to be accommodate short or long strap receptacles.

2.6 RIGID CONDUIT BOXES

- .1 Cast FS or FD ferrous rigid conduit boxes with factory-threaded hubs and mounting feet for surface wiring where rigid conduit other than "EMT" is used.

2.7 MULTI-OUTLET BOXES

- .1 Electro-galvanized steel barrier pre-ganged multi-outlet boxes for devices with different sources of voltage in the same box.
- .2 The barrier of sheet steel shall not be less than (No. 16 MSG) thick used to divide the space into separate compartments for the conductors of each system. The barrier shall be fastened rigidly to the box.

2.8 FITTINGS-GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 32mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.9 CONDUIT SUPPORTS

- .1 In steel stud framing construction provide for boxes a metal stud clip (Caddy MSF) and a far side support (Caddy 766) or a separate quick mount support (Caddy "H" Series).
- .2 Use adjustable screws gun brackets (caddy "TS" series) where box requires mounting between steel studs.
- .3 Other support system will be accepted only after review by Engineer.

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 construction material.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 65mm of opening.
- .4 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers not allowed.
- .5 At each local switch, receptacle, ceiling or wall fixture, continuous row of fixtures, or system unit (i.e. fire alarm, T.V., etc.) provide and install a standard or twin filler or barrier pressed steel outlet box, unless specifically noted otherwise. All outlet boxes shall be fabricated of galvanized sheet steel and set flush with finished surfaces. They shall be rigidly and securely set.
- .6 All flexible conduit fixture feeds shall originate from the side of the outlet box and not from the box

- cover.
- .7 In locating outlets, take care to allow for radiation, pipes, ducts, etc., and for the variation in arrangement and thickness of finishes, etc. Failure to comply with this will not relieve Division 26 Contractor from the cost of necessary alterations.
 - .8 Allow for the relocation of an outlet up to a dimension of 3m from that indicated on drawings, provided notice is given before roughing-in has been completed.
 - .9 Install floor boxes in concrete formwork, prior to concrete pour, securely set to ensure finished collar is flush with the surface of the specified finish flooring.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 29-M1983 - Panelboards and panelboard enclosures.

1.2 RELATED WORK

- .1 Electrical General Instructions: Section 26 05 00.
- .2 Moulded Case Circuit Breakers: Section 26 28 16

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 OPERATION AND MAINTENANCE MANUAL

- .1 Incorporate into maintenance manual specified in Section 01 78 00.

2 Products

2.1 PANELBOARDS

- .1 Panelboards: product of one manufacturer.
- .2 Type: 600V and 250V LT, 3 phase, 4 wire, as indicated.
- .3 Panelboards shall have surface trim and doors finished for surface or flush mounted as shown on drawings, bolt-on circuit breaker type, sized and of types and electrical characteristics as indicated on drawings.
- .4 Cabinets for panelboards shall be minimum number 14 gauge galvanized steel, minimum of 508mm wide and 147mm deep, of dead front construction, and doors shall be single type, 120 degree door swing, with spring latch and lock. Two keys shall be supplied with each panelboard and all shall be keyed alike. Surface mounted panelboards shall be finished in ASA61 baked enamel. Panel bus bars shall be of aluminum with lugs suitable for copper conductor connections.
- .5 Drip Hoods: on all surface mounted panelboards factory installed.
- .6 All 3 phase, 4 wire panelboards rated at 225 amperes or less to have grounding terminal strip supplied and installed by manufacturer capable of terminating a minimum of two #2s, four #6s with balance of terminations to accept #12 conductors.
- .7 All panelboards rated at 225 amperes or less with voltages and phases as indicated on drawings requiring isolated grounding, to be capable of terminating quantities and sizes as indicated on electrical drawings.
- .8 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.
- .9 Ratings: mains, number of circuits, and number and size of main and branch circuit breakers as indicated in panel schedules.

2.2 BREAKERS

- .1 Breakers: To Section 26 28 16
- .2 Breakers with thermal magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: When indicated separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker. If main breaker is mounted on the

- bottom of panel, panel shall be approved for that purpose and shall be so marked.
- .4 Lock-on devices on handles of circuit breakers ARE to be installed for exit light circuits, fire alarm circuits, CCTV system, alarm monitoring and security, sump pumps to prevent accidental operation.
 - .5 Breakers to be installed in panel board before shipping.

2.3 EQUIPMENT IDENTIFICATION

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

2.4 MANUFACTURERS

- .1 Standard of Acceptance: Cutler Hammer, PRL
- .2 Other approved manufacturers: Federal Pioneer, Siemens, Square D.

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 or as indicated.
- .4 Connect loads to circuits as indicated.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Panels shall be installed in an upright position and the bottom of the panelboard shall be located not less than 1000mm above finished floor level where practicable.
- .7 Install a typed directory under transparent cover on the inside of each new panelboard showing the location and load connected to each circuit.
- .8 Wiring in panelboards shall be secured with tie rap or equivalent means to present a neat workmanlike appearance. Branch circuitry wiring within panelboards shall have approximately 300mm of "slack" wire installed in 150mm loop adjacent to respective breakers where phase conductors terminate. All branch circuit neutral, ground and/or bond conductors to have approximately 300mm of slack wire neatly "looped" prior to terminations taking place. All feeder conductors to be installed in such a manner as to enable "clip on" type capacitive leakage tester to encompass neutral plus phase conductors together. Feeder conductors to be provided with additional slack wire adjacent to termination lugs.
- .9 Panels shall be flush or surface mounted as indicated in the schedule and shall be equipped with all breakers of the amperage and interrupting capacity noted on the drawings.
- .10 Run two 25mm spare conduits up to the ceiling space from each flush panel. Terminate these conduits in a 150 x 150 x 150mm junction box in the ceiling space. Box to have affixed nameplate indicating panel.
- .11 Circuit numbers on drawings do not necessarily correspond to the numbers on the lighting and power panels. Circuits sharing a common neutral shall not be connected to the same phase. Any changes in circuit numbering is to be included on "record drawings". Individual light fixtures fed with two branch circuits are to derive their source from two pole breakers.
- .12 The Lamacoid identification plate on panelboards shall include the voltage phase and wires and amperage (of breaker or fuse protecting it) in addition to the panel designation itself.

- .13 "Labelling" of all branch circuit phase conductors plus neutral and/or bond conductors shall be done with "Panduit" write-on, self laminating labels Nos. PDL-1 and PDL-2 as required or approved equal.
- .14 Maximum size conduits housing 15A or 20A branch circuits to be limited to 25mm in size exiting any panelboard.

3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 00.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 76 - Splitters.
- .2 CSA C22.2 No. 40 - Junction and pull boxes.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and products data for splitters and cabinets in accordance with Section 01 33 00.
- .2 Provide list of color-coding for incorporation into operation and maintenance manuals as specified in Section 01 78 00 and 26 05 00.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 SPLITTERS

- .1 All splitter troughs are to feature 3 bus copper bars on insulated base.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 All splitter troughs to have grounding terminal strip factory installed in addition to required phase and/or neutral blocks required.
- .4 At least three spare terminals on each set of lugs in splitters less than 400A.

2.2 JUNCTION AND PULL BOXES

- .1 Pull and junction boxes, where larger than standard switch boxes, shall be sized according to C.E.C. Section 12-3038.
- .2 Welded steel construction with screw-on flat covers for surface mounting.
- .3 Covers with 25mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

- .1 Cabinets shall be steel fabricated to CSA and EEMAC Standards with baked enamel finish. Cabinets shall be EEMAC Standard Types "E" or "T" as indicated on the drawings.
 - .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
 - .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19mm plywood backboard for surface or flush mounting as indicated.

2.4 MANUFACTURERS

- .1 Acceptable Material: Bel
- .2 Other approved manufactures: Hammond, Hoffman.

3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitters plumb and square to building floor at convenient location between 675mm and 3600mm above finished floor.
- .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 2000mm above finished floor.
- .3 Install terminal block as indicated in Type "T" cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 1000 ft. of conduit run between pull boxes.
- .5 In no case shall a pull or junction box be installed in a ceiling space that is not considered accessible unless provision is made for access to the box as approved by Architect and/or Engineer. Boxes and plates exposed to view and in suspended ceilings shall be colour coded (brush painted only) as specified below:
- .6

System	Colour
.1 600/347V Power	Orange
.2 120/208V Lighting and Power	Yellow
.3 Telephone/Data	Black
.4 Fire Alarm	Red
.5 Grounding	Green
.6 Sound	Brown
- .7 Colour codes will be permitted to change only upon permission from Architect and/or Engineer
- .8 A wood framed plexiglass picture is to be supplied and mounted in the main electrical room. It shall be type written with the system colour and also a sample of paint adjacent.
- .9 Tiles or access hatches or doors for locating boxes shall be identified with approved type locating indicators and not tacks.
- .10 Coverplates for junction and/or pull boxes located above concealed accessible ceilings housing branch circuits for 600/347/4 wire and 208/120V/4 wire systems to have branch circuit breaker numbers neatly identified on plate, felt marker will suffice, boxes housing 5 circuits or less.
- .11 All branch conductors to be identified in all junction and/or pull boxes with "Panduit" write-on, self-laminating label Nos. PLD-1 and PLD-2 as required or approved equal by Thomas & Betts.
- .12 All junction boxes containing six or more branch circuits shall be installed in type "E" box c/w terminal strip. Minimum size of box to be 300mm x 300mm x 100mm.
- .13 Terminal strip(s) to be large enough to terminate all phase, neutral and bonding conductors as required plus size spare terminals.
- .14 All "E" box coverplates to have "Lamicoid" nameplates identifying designated panel letter and/or number affixed via pop rivet method.
- .15 All pull and junction boxes 150mm x 150mm and larger having auxiliary systems housed within shall be identified with "Lamicoid" nameplates permanently affixed.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Install size 2 identification labels indicating system name, voltage, and phase.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 111 - General Use Switches.
- .2 CSA C22.2 No. 42 - General Use Receptacles, Attachment Plugs and Similar Wiring Devices.

1.2 RELATED WORK

- .1 Not Applicable.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Section 01 33 00 - Submit shop drawings and product data in accordance.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 SWITCHES

- .1 15A,120V, Single pole, specification grade, black, toggle switch Hubbell # 1201.

2.2 LOW VOLTAGE SWITCHING

- .1 Not Applicable

2.3 AUTOMATIC MOTION CONTROL

- .1 Not Applicable.

2.4 POWER AND COMMUNICATION POLES (PAC)

- .1 Not Applicable

2.5 RECEPTACLES

- .1 CSA 5-15R, 125V, duplex, black in color, specification grade receptacle only.
 - .1 Standard of Acceptance: Hubbell #CR5252
- .2 CSA 5-20RA, 20 AMP T Slot, Duplex, black in color, specification grade receptacles only.
 - .1 Acceptable Material: Hubbell #CR5352
- .3 Receptacles of one manufacturer throughout project whenever possible.

2.6 COVER PLATES

- .1 Coverplates for all non-weatherproof specified receptacles shall be stainless steel.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Cast cover plates for wiring devices mounted in surface-mounted outlet boxes.

2.7 MANUFACTURERS

- .1 Acceptable Material: Hubbell, Leviton, Watt Stopper, Wiremold.

3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Mount switches at height specified in Section 26 05 00 or as indicated.
 - .2 All switches and their wall plates, shall be installed plumb, with switch handle in the "up" position when switch is closed.
 - .3 Group switches under one wall plate in gang type box where more than one switch is shown at one location and when more than three are grouped.
 - .4 Where light switches, thermostats, receptacles, etc., are located in close proximity with one another, they are to be located on the same vertical centerline at their respective heights.
- .2 Receptacles:
 - .1 Mount receptacles at height specified in Section 26 05 00 or as indicated.
 - .2 Install a green insulated ground conductor, between the grounding terminal of the receptacle and the grounding screw and stud of the outlet box. Minimum size of ground and/or bonding cables are to be #12 AWG.
 - .3 Group receptacles under one wall plate in gang type box, where more than one outlet is shown at one location. The use of sectional boxes whether single or multi-ganged shall be restricted for use with flexible conduits, cables or other types of pliable cables.
 - .4 Receptacles above counters shall be installed above the splashback to a height as indicated on the drawings and coordinated on the site.
 - .5 Receptacles installed on raceways to be fitted with raceway cut outs and fittings.
- .3 Coverplates:
 - .1 Coverplates to be installed plumb and have stainless steel screws.
 - .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.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 Not Applicable

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Submit fuse time-current characteristics for each fuse type and size above 400 A. Time-current characteristics to include: average melting time-current, I^2t (for fuse coordination), and peak let-through current.
- .3 Submit shop drawing on fuse storage cabinet.
- .4 Ship fuses in original containers.
- .5 Do not ship fuses installed in equipment.
- .6 Store fuses in original containers in storage cabinet, moisture free location.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Provide maintenance materials in accordance with Section 01 78 00.
- .2 Three spare fuses of each type and size installed.

2 Products

2.1 FUSES GENERAL

- .1 HRC fuses to have interrupting capability of 200,000 RMS AMPS symmetrical.
- .2 Fuses: product of one manufacturer.
- .3 Fuses shall be of silver element construction and rated for 250 volt.

2.2 FUSE TYPES

- .1 Form 1, HRC fuses, Class J:
 - .1 Time delay, Type AJT.
 - .2 Fast acting, Type CJ.

2.3 MANUFACTURERS

- .1 Acceptable Material: Gould Shownut Company.
- .2 Other approved manufacturers: Littlefuse and Bussman.

3 Execution

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Use Type J fuses only except where specified otherwise.
- .5 Fuse sizes shall be as indicated on the drawings.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 5.1 - Moulded Case Circuit Breakers.

1.2 RELATED WORK

- .1 Not Applicable

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Include time-current characteristic curves for breakers with ampacity of 400A and over or with interrupting capacity of 22,000A symmetrical rms and over at system voltage.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Not Applicable

2 Products

2.1 BREAKERS GENERAL

- .1 Bolt on moulded case circuit breaker, quick-make, quick-break type, de-ionizing arc chambers for manual and automatic operation with temperature compensation for 40EC ambient. Breakers to be trip free of operating handles on overloads with a definite indication when tripping has taken place.
- .2 Multi-pole breakers shall have common trip mechanisms; tie handles will not be acceptable.
- .3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 10 to 12 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Minimum acceptable circuit breaker interrupting rating shall be 14,000 RMS symmetrical amperes or as indicated on the drawings.

2.2 MANUFACTURERS

- .1 Standard of Acceptance: FPE.
- .2 Other approved manufacturers: Cutler Hammer, Siemens, Square D.

3 Execution

3.1 INSTALLATION

- .1 Circuit breakers shall be securely mounted in switchboards, panelboards, or EEMAC one (1) enclosures as indicated on the drawings and as required by other sections of the specifications.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 CSA C22.2 No. 39 - Fuseholder Assemblies.
- .2 CSA C22.2 No. 4 - Enclosed switches.

1.2 RELATED WORK

- .1 Electrical General Instructions: Section 26 05 00
- .2 Fuses Low Voltage: Section 26 28 13

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and Product Data in accordance with Section 01 33 00.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation into Maintenance Manuals as specified in Sections 01 78 00 and 26 05 00.

2 Products

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible disconnect switches in CSA enclosures as indicated.
- .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 ON-OFF switch position indication on switch enclosure cover.
- .5 Fuses: size as indicated, to Section 26 28 13.
- .6 Fuseholders: suitable without adaptors, for type and size of fuse as indicated.
- .7 Quick-make, quick-break action.
- .8 Elevator disconnects to be fused, complete with auxillary contacts.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 MANUFACTURERS

- .1 Standard of Acceptance: Cutler Hammer.
- .2 Other approved manufacturers: Federal Pioneer, Siemens, Square D.

3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches as indicated.
- .2 Mount all disconnect switches in a secure manner, easily accessible, and at a height as specified in Section 26 05 00.
- .3 In finished areas mount disconnect switch on top of flush mounted junction box with conduit nipple on its coverplate into back of the switch.

End of Section

1 General

1.1 REFERENCE STANDARDS

- .1 IEC 947.4-1, Part 4 - Contactors and Motor Starters.

1.2 RELATED WORK

- .1 Not Applicable.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.
 - .7 Coordinate with Mechanical Contractor other contracts and equipment suppliers to obtain all motor data to ensure correct overload protection, over current protection, and correct control equipment and sequence.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation into maintenance manual specified in Sections 01 78 00 and 26 05 00.
- .2 Include operation and maintenance data for each type and style of starter.

2 Products

2.1 MATERIALS

- .1 Starters: EEMAC E14-1.
 - .1 Half size starters not acceptable.

2.2 MANUAL MOTOR STARTERS

- .1 Single, and three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One or three overload heaters as required, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Pushbutton: heavy duty labelled as indicated on three phase starters.
 - .2 Toggle: labelled on single phase starters.
 - .3 Indicating light: standard type and color as indicated.
 - .4 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type. Solenoid operating voltage: 120V AC.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Power and control terminals.
 - .4 Wiring and schematic diagram inside starter enclosure in visible location.
 - .5 Identified each wire and terminal for external connections, within starter, with permanent

number marking identical to diagram.

- .2 Accessories:
 - .1 H-O-A selector switches or push buttons: heavy duty, labelled as indicated.
 - .2 Indicating Lights: Standard type and colour.
 - .3 N/O and N/C spare auxiliary contacts as indicated.
 - .4 Remote START/STOP pushbutton control, as indicated.
 - .5 Control transformer: to Paragraph 2.5 of this Section.

2.4 FULL VOLTAGE COMBINATION STARTERS

- .1 Combination type starters to consist of a magnetic starter as in Par. 2.3.1, and MCP breaker, and provisions for:
 - .1 Locking in "OFF" position with up to 3 padlocks.
 - .2 Locking in "ON" position.
 - .3 Independent locking of enclosure door.
 - .4 Provision for preventing switching to "ON" position while enclosure door open.
- .2 Accessories:
 - .1 Same as for magnetic starters Par. 2.3.2.

2.5 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as required and 120V secondary, c/w secondary fuse, installed within starter enclosure.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.6 SAFETY DISCONNECT SWITCHES

- .1 One, two, three and six pole manual disconnect switches of size and type as indicated.
- .2 A manual disconnect switch of appropriate type and size shall be provided for each motor if such motor is not visible from the location of the starter or disconnecting means, i.e. panel breaker, combination starter, etc.
- .3 This Contract shall provide all required disconnect switches except those provided by Section 15 Contractor.

2.7 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00.

2.8 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic/combination magnetic starter designation label, white plate, black letters, size 2 engraved as per Section 26 05 00.

2.9 MANUFACTURERS

- .1 Standard of Acceptance: Square D
- .2 Other Approved Manufacturers: Allen-Bradley, Cutler-Hammer, Siemens.

3 Execution

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.
- .3 Manual and combination magnetic starters shall be provided for all motors, unless specifically noted otherwise.

- .4 Mount all starters in a secure manner, easily accessible, and 1500mm to centre, above the floor unless indicated otherwise. In finished areas mount magnetic starters on top of flush mounted junction box with conduit nipple on its coverplate into the back of the switch.
- .5 Obtain full load nameplate ampere ratings of respective motors and install thermal overloads of appropriate size.
- .6 Refer to motor schedule for control and starter details.

3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 00 and manufacturer's instructions.
- .2 Operate switches, contactors, push buttons to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated. This work to be coordinated with Mechanical Contractor, other contracts and equipment suppliers where applicable.

End of Section

1 General

1.1 REFERENCES

- .1 CSA C22.2 No. 9-1968 - General Requirements for Luminaires.
- .2 CSA C22.2 No. 43-1965 - Socket screw-shell lampholders.
- .3 CSA C22.2 No. 74 - Discharge lampholders.
- .4 CSA C22.2 No. 84 - Incandescent lamps.
- .5 CSA C22.2 No. 84-1974 - Tungsten halogen lamps.
- .6 ANSI C78 series - Fluorescent lamps.
- .7 CSA C22.2 No. 74 - Ballasts. Equipment for use with Electric Discharge Lamps.
- .8 CSA C22.2 No. 8 - Radio interference suppressor. Electromagnetic Interference (EMI) Fitters.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 22 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 45 00 - Testing and Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Engineer.
- .3 Photometric data to include: VCP Table.

1.4 JOB MOCK-UP

- .1 Not Applicable

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 22 - 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.
- .4 Disposal of fluorescent lamps.
- .5 Disposal of old PCB filled ballasts (if still existing) on renovation jobs.

1.6 GUARANTEE

- .1 Replace:
 - .1 Fluorescent and HID lamps burning out within 12 months of takeover.
 - .2 Ballasts that fail or exceed their original noise level rating within 12 months of takeover.

2 Products

2.1 LAMPS

- .1 Standard of Acceptance: GE
- .2 Other approved manufacturer: OSRAM

2.2 BALLASTS

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic design.
 - .1 Rating: 120 V, 60 Hz.
 - .2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
 - .3 Totally encased and designed for 40 °C ambient temperature.
 - .4 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .5 Crest factor: 1.5 maximum current, 2.0 maximum voltage.
 - .6 Capacitor: thermally protected.
 - .7 Thermal protection: non-resettable on coil.
 - .8 Harmonics: 10 % maximum THD.
 - .9 Operating frequency of electronic ballast: 21 khz minimum.
 - .10 Ballast Factor: greater than 0.90.
 - .11 Sound rated: Class A.
 - .12 Mounting: As noted on drawings.

2.3 LIGHT CONTROL DEVICES

- .1 Not Applicable

2.4 LUMINAIRES

- .1 Fixture Schedule
 - .1 Type A - Recessed lensed fluorescent fixture 610mm x 1220mm, 3 28-watt-T8 lamps, CRI of 80, 3500K, (2) 120 volt ballast, one ballast for the center lamp and one ballast for the two outside lamps, A19 Lens. CFI#AA348
- .2 Manufacturers
 - .1 Standard of Acceptance: CFI
 - .2 Other Approved manufacturers: Cooper Group, Hubbell Group, Juno, Lithonia

3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 As noted on drawings.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

End of Section