ELECTRICAL SPECIFICATIONS - ELECTRICAL CONTRACTOR (2 OF 2)

16141 - WIRING DEVICES

1.1 SHOP DRAWINGS AND PRODUCT DATA
.1 SUBMIT SHOP DRAWINGS AND PRODUCT DATA FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.

2.1 SWITCHES
.1 15A, SINGLE POLE, THREE-WAY SWITCHES.
.2 MANUALLY-OPERATED GENERAL PURPOSE AC SWITCHES WITH FOLLOWING FEATURES:
.1 TERMINAL HOLES APPROVED FOR NO. 10 AWG WIRE.
.2 SILVER ALLOY CONTACTS.
.3 UREA OR MELAMINE MOLDING FOR PARTS SUBJECT TO CARBON TRACKING.
.4 SUITABLE FOR BACK AND SIDE WIRING.
.5 STYLE & COLOUR AS NOTED, SPECIFICATION GRADE.
.3 TOGGLE OPERATED FULLY RATED FOR TUNGSTEN FILAMENT AND FLUORESCENT LAMPS, AND UP TO 80% OF RATED CAPACITY OF MOTOR LOADS.
.4 SWITCHES OF ONE MANUFACTURER THROUGHOUT PROJECT.
.5 ACCEPTABLE MATERIALS: HUBBELL, LEVITON, ARROW HART, PASS & SEYMOUR.

2.2 RECEPTACLES
.1 DUPLEX RECEPTACLES, CSA TYPE 5-15 R, 125 V, 15 A, U GROUND, WITH FOLLOWING FEATURES:
.1 SUITABLE FOR NO. 10 AWG FOR BACK AND SIDE WIRING.
.2 BREAK-OFF LINKS FOR USE AS SPLIT RECEPTACLES.
.3 EIGHT BACK WIRED ENTRANCES, FOUR SIDE WIRING SCREWS.
.4 TRIPLE WIPE CONTACTS AND RIVETTED GROUNDING CONTACTS.
.5 STYLE & COLOUR AS NOTED, SPECIFICATION GRADE
.2 OTHER RECEPTACLES WITH AMPACITY AND VOLTAGE AS INDICATED.
.3 RECEPTACLES OF ONE MANUFACTURER THROUGHOUT PROJECT.
.4 ACCEPTABLE MATERIALS: HUBBELL, LEVITON, ARROW HART, PASS & SEYMOUR.

2.3 COVER PLATES
.1 COVER PLATES FOR WIRING DEVICES.
.2 COVER PLATES FROM ONE MANUFACTURER THROUGHOUT PROJECT.
.3 SHEET STEEL UTILITY BOX COVER FOR WIRING DEVICES INSTALLED IN SURFACE-MOUNTED UTILITY BOXES.
.4 STAINLESS STEEL, VERTICALLY BRUSHED, 1/32" (1 mm) THICK COVER PLATES, THICKNESS 1/16" (2.5 MM) FOR WIRING DEVICES MOUNTED IN FLUSH-MOUNTED OUTLET BOX.
.5 SHEET METAL COVER PLATES FOR WIRING DEVICES MOUNTED IN SURFACE-MOUNTED FS OR FD TYPE CONDUIT BOXES.

3.1 INSTALLATION
.1 SWITCHES:
.1 INSTALL SINGLE THROW SWITCHES WITH HANDLE IN "UP" POSITION WHEN SWITCH CLOSED.
.2 INSTALL SWITCHES IN GANG TYPE OUTLET BOX WHEN MORE THAN ONE SWITCH IS REQUIRED IN ONE LOCATION.
.3 MOUNT TOGGLE SWITCHES AT HEIGHT SPECIFIED IN SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS OR AS INDICATED.
.2 RECEPTACLES:
.1 INSTALL RECEPTACLES IN GANG TYPE OUTLET BOX WHEN MORE THAN ONE RECEPTACLE IS REQUIRED IN ONE LOCATION.
.2 MOUNT RECEPTACLES AT HEIGHT SPECIFIED IN SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS OR AS INDICATED.
.3 WHERE SERVE RECEPTACLE HAS ONE PORTION SWITCHED, MOUNT VERTICALLY AND SWITCH UPPER PORTION.
.3 COVER PLATES:
.1 PROTECT STAINLESS STEEL COVER PLATE FINISH WITH PAPER OR PLASTIC FILM UNTIL PAINTING AND OTHER WORK IS FINISHED.
.2 INSTALL SUITABLE COMMON COVER PLATES WHERE WIRING DEVICES ARE GROUPED.
.3 DO NOT USE COVER PLATES MEANT FOR FLUSH OUTLET BOXES ON SURFACE-MOUNTED BOXES.

16223 - MOTOR STARTERS TO 600V

1.1 SUBMITTALS
.1 SUBMIT SHOP DRAWINGS AND PRODUCT DATA FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.
.2 INDICATE THE FOLLOWING:
MOUNTING METHOD AND DIMENSIONS
STARTER SIZE AND TYPE
LAYOUT OF IDENTIFIED INTERNAL AND FRONT PANEL COMPONENTS
ENCLOSURE TYPE
WIRING DIAGRAM FOR EACH TYPE OF STARTER
INTERCONNECTION DIAGRAM

1.2 OPERATION AND MAINTENANCE DATA
.1 PROVIDE DATA FOR INCORPORATION INTO MAINTENANCE MANUAL SPECIFIED IN SECTION 16010.
.2 INCLUDE OPERATION AND MAINTENANCE DATA FOR EACH TYPE AND STYLE OF STARTER.

2.1 STANDARDS
.1 STARTERS: TO C.S.A. C22.2, NO. 14, EEMAC E14-1.

2.2 MANUAL MOTOR STARTERS
.1 MANUAL MOTOR STARTERS OF SIZE, TYPE AS INDICATED AND SUITABLE FOR THE MOTOR LOAD TO BE CONTROLLED, WITH COMPONENTS AS FOLLOWS:
.1 SWITCHING MECHANISM, QUICK-MAKE AND BREAK.
.2 OVERLOAD HEATER IN EACH PHASE, MANUAL RESET, TRIP INDICATING HANDLE.
.3 HEAVY-DUTY TYPE, LABELLED TOGGLE SWITCH, UNLESS INDICATED OTHERWISE.
.4 INDICATING LIGHT: HEAVY-DUTY TYPE, RED.
.5 LOCKING TAB TO PERMIT PADLOCKING IN "ON" OR "OFF" POSITION

2.3 FULL VOLTAGE MAGNETIC STARTERS
.1 MAGNETIC AND COMBINATION MAGNETIC STARTERS MINIMUM SIZE1. TYPE, RATING AND ENCLOSURE TYPE AS INDICATED WITH COMPONENTS AS FOLLOWS:
.1 CONTROL TRANSFORMER.
.2 CONTACTOR SOLENOID OPERATED, RAPID ACTION TYPE.
.3 MOTOR OVERLOAD PROTECTIVE DEVICE IN EACH PHASE, MANUALLY RESET FROM FRONT WITH DOOR CLOSED.
.4 WIRING AND SCHEMATIC DIAGRAM INSIDE STARTER ENCLOSURE IN VISIBLE LOCATION.
.2 COMBINATION-TYPE STARTERS TO INCLUDE FUSED DISCONNECT SWITCH WITH OPERATING LEVER ON OUTSIDE OF ENCLOSURE TO CONTROL DISCONNECT AND PROVISION FOR:
LOCKING IN "OFF" POSITION WITH UP TO THREE (3) PADLOCKS.
LOCKING IN "ON" POSITION.
INDEPENDENT LOCKING OF ENCLOSURE DOOR.
PROVISION FOR PREVENTING SWITCHING TO "ON" POSITION WHILE ENCLOSURE DOOR IS OPEN.
.3 ACCESSORIES
.1 PUSHBUTTONS AND SELECTOR SWITCHES: HEAVY DUTY TYPE AND LABELLED AS INDICATED.
.2 INDICATING LIGHTS: HEAVY DUTY TYPE - RED COLOUR UNLESS INDICATED OTHERWISE.
.3 TWO N/O AND TWO N/C AUXILIARY CONTACTS UNLESS OTHERWISE INDICATED.

2.4 CONTROL TRANSFORMER
.1 SINGLE PHASE, DRY-TYPE, CONTROL TRANSFORMER WITH PRIMARY VOLTAGE INDICATED AND 120 VOLT SECONDARY, COMPLETE WITH SECONDARY FUSE, ALL INSTALLED IN STARTER ENCLOSURE.
.2 SIZE CONTROL TRANSFORMER FOR CONTROL CIRCUIT LOAD PLUS 20% SPARE CAPACITY.

2.5 FINISHES
.1 APPLY FINISHES TO ENCLOSURE IN ACCORDANCE WITH SECTION 16010.

2.6 EQUIPMENT IDENTIFICATION
.1 PROVIDE EQUIPMENT IDENTIFICATION IN ACCORDANCE WITH SECTION 16010.

2.7 ACCEPTABLE MANFACTURERS
.1 CUTLER-HAMMER CANADA LTD.
.2 SQUARE 'D' CO.
.3 ALLEN-BRADLEY CANADA COMPANY
.4 SIEMENS CANADA LTD.
.5 CANADIAN GENERAL ELECTRIC

EXECUTION

3.1 INSTALLATION
.1 INSTALL STARTERS, CONNECT POWER AND CONTROL WIRING AS INDICATED.
.2 ENSURE CORRECT FUSES AND OVERLOAD DEVICES ARE INSTALLED.

3.2 TESTS
.1 PERFORM TESTS IN ACCORDANCE WITH SECTION 16010 AND MANUFACTURER'S INSTRUCTIONS.
.2 OPERATE SWITCHES, CONTACTORS 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.

16271 - DRY TYPE TRANSFORMERS UP TO 600V PRIMARY

1.1 PRODUCT DATA
.1 SUBMIT SHOP DRAWINGS AND PRODUCT DATA FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.

2.1 TRANSFORMERS
.1 USE TRANSFORMERS OF ONE MANUFACTURER THROUGHOUT PROJECT.
.2 DESIGN:
.1 TYPE: ANN
.2 3 PHASE, KVA AS NOTED, 600 V INPUT, 120/208 V OUTPUT, 60 HZ.
.3 VOLTAGE TAPS: STANDARD
.4 INSULATION: CLASS 220, 150°C TEMPERATURE RISE.
.5 BASIC IMPULSE LEVEL (BIL): STANDARD
.6 HIPOT: STANDARD
.7 AVERAGE SOUND LEVEL: 50 DB
.8 IMPEDANCE AT 170°C: STANDARD
.9 ENCLOSURE: EEMAC 1, REMOVABLE METAL FRONT PANEL
.10 MOUNTING: FLOOR.
.11 FINISH: IN ACCORDANCE WITH SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS

2.2 EQUIPMENT INDENTIFICATION
.1 PROVIDE EQUIPMENT IDENTIFICATION IN ACCORDANCE WITH SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS.
.2 LABEL SIZE: 7

3.1 INSTALLATION
.1 MOUNT DRY TYPE TRANSFORMERS UP TO 75 KVA AS INDICATED.
.2 MOUNT DRY TYPE TRANSFORMERS ABOVE 75 KVA ON FLOOR COMPLETE WITH STEEL FRAME RAILS ON 100mm (4") CONCRETE HOUSE KEEPING PAD OR AS INDICATED.
.3 ENSURE ADEQUATE CLEARANCE AROUND TRANSFORMER FOR VENTILATION.
.4 INSTALL TRANSFORMERS IN LEVEL UPRIGHT POSITION.
.5 REMOVE SHIPPING SUPPORTS ONLY AFTER TRANSFORMER IS INSTALLED AND JUST BEFORE PUTTING INTO SERVICE.
.6 LOOSEN ISOLATION PAD BOLTS UNTIL NO COMPRESSION IS VISIBLE.
.7 MAKE PRIMARY AND SECONDARY CONNECTIONS IN ACCORDANCE WITH WIRING DIAGRAM.
.8 ENERGIZE TRANSFORMERS AFTER INSTALLATION IS COMPLETE.

16412 - MOULDED CASE CIRCUIT BREAKERS

1.1 PRODUCT DATA
.1 SUBMIT PRODUCT DATA AND SHOP DRAWINGS FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.
.2 INCLUDE TIME-CURRENT CHARACTERISTIC CURVES FOR BREAKERS.

2.1 BREAKERS GENERAL
.1 BOLT-ON MOULDED CASE CIRCUIT BREAKER: QUICK-MAKE, QUICK-BREAK TYPE, FOR MANUAL AND AUTOMATIC OPERATION WITH TEMPERATURE COMPENSATION FOR 40°C AMBIENT.
.2 PLUG-IN MOULDED CASE CIRCUIT BREAKERS: 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.
.4 MAGNETIC INSTANTANEOUS TRIP ELEMENTS IN CIRCUIT BREAKERS TO OPERATE ONLY WHEN VALUE OF CURRENT REACHES SETTING. TRIP SETTINGS ON BREAKERS WITH ADJUSTABLE TRIPS TO RANGE FROM 3-8 TIMES CURRENT RATING.
.5 CIRCUIT BREAKERS WITH INTERCHANGEABLE TRIPS AS INDICATED.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A
.1 MOULDED CASE CIRCUIT BREAKER TO OPERATE AUTOMATICALLY BY MEANS OF THERMAL AND MAGNETIC TRIPPING DEVICES TO PROVIDE INVERSE TIME CURRENT TRIPPING AND INSTANTANEOUS TRIPPING FOR SHORT CIRCUIT PROTECTION.

2.3 MAGNETIC BREAKERS DESIGN B
.1 MOULDED CASE CIRCUIT BREAKER TO OPERATE AUTOMATICALLY BY MEANS OF MAGNETIC TRIPPING DEVICES TO PROVIDE INSTANTANEOUS TRIPPING FOR SHORT CIRCUIT PROTECTION.

2.4 FUSED THERMAL MAGNETIC BREAKERS DESIGN C
.1 FUSED THERMAL MAGNETIC BREAKERS WITH CURRENT LIMITING FUSES INTERNALLY MOUNTED. TIME CURRENT LIMITING CHARACTERISTICS OF FUSES COORDINATED WITH TIME CURRENT TRIPPING CHARACTERISTICS OF CIRCUIT BREAKER, COORDINATION TO RESULT IN INTERRUPTION BY BREAKER OF FAULT-LEVEL CURRENTS UP TO INTERRUPTING CAPACITY OF BREAKER. FUSES INDIVIDUALLY REMOVABLE AND INTERLOCKED WITH BREAKER. THE REMOVAL OF FUSE COVER, BLOWING OF A FUSE OR REMOVAL OF A FUSE, TO TRIP BREAKER.

2.5 SOLID STATE TRIP BREAKERS DESIGN D
.1 MOULDED CASE CIRCUIT BREAKER TO OPERATE BY MEANS OF A SOLID-STATE TRIP UNIT WITH ASSOCIATED CURRENT MONITORS AND SELF-POWERED SHUNT TRIP TO PROVIDE INVERSE TIME CURRENT TRIP UNDER OVERLOAD CONDITION, AND LONG TIME SHORT TIME INSTANTANEOUS TRIPPING FOR PHASE GROUND FAULT SHORT CIRCUIT PROTECTION.

2.6 OPTIONAL FEATURES
.1 INCLUDE:
.1 SHUNT TRIP.
.2 AUXILIARY SWITCH.
.3 MOTOR-OPERATED MECHANISM C/W TIME DELAY UNIT.
.4 UNDER-VOLTAGE RELEASE.
.5 ON-OFF LOCKING DEVICE.
.6 HANDLE MECHANISM.

2.7 ACCEPTABLE MANUFACTURERS
.1 APPROVED MANUFACTURERS ARE CUTLER-HAMMER, SQUARE 'D' CO., ALLEN-BRADLEY CANADA CO., SIEMENS CANADA LTD. AND CANADIAN GENERAL ELECTRIC.

3.1 INSTALLATION
.1 INSTALL CIRCUIT BREAKERS AS INDICATED.

16414 - DISSCONNECT SWITCHES - FUSES AND NON-FUSED

1.1 PRODUCT DATA
.1 SUBMIT PRODUCT DATA AND SHOP DRAWINGS FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.

2.1 DISCONNECT SWITCHES
.1 FUSIBLE, NON-FUSIBLE DISCONNECT SWITCH IN CSA ENCLOSURE, SIZE 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 FUSES: SIZE AS INDICATED.
.5 FUSEHOLDERS: RELOCATABLE AND SUITABLE WITHOUT ADAPTORS, FOR TYPE AND SIZE OF FUSE INDICATED.
.6 QUICK-MAKE, QUICK-BREAK ACTION.
.7 ON-OFF SWITCH POSITION INDICATION ON SWITCH ENCLOSURE COVER.

2.2 EQUIPMENT IDENTIFICATION
.1 PROVIDE EQUIPMENT IDENTIFICATION IN ACCORDANCE WITH SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS.
.2 INDICATE NAME OF LOAD CONTROLLED ON SIZE 4 NAMEPLATE.

2.3 ACCEPTABLE MANUFACTURERS
.1 APPROVED MANUFACTURERS ARE CUTLER-HAMMER, SQUARE 'D' CO., ALLEN-BRADLEY CANADA CO., SIEMENS CANADA LTD. AND CANADIAN GENERAL ELECTRIC.

3.1 INSTALLATION
.1 INSTALL DISCONNECT SWITCHES COMPLETE WITH FUSES IF APPLICABLE.

16421 - CONTACTORS

1.1 PRODUCT DATA
.1 SUBMIT PRODUCT DATA AND SHOP DRAWINGS FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.

2.1 CONTACTORS
.1 CONTACTORS: TO EEMAC NO.1CS.
.2 ELECTRICALLY HELD CONTROLLED BY PILOT DEVICES AS INDICATED AND RATED FOR TYPE OF LOAD CONTROLLED.
.3 BREAKER COMBINATION CONTACTOR AS INDICATED.
.4 COMPLETE WITH 2 NORMALLY OPEN AND 2 NORMALLY CLOSED AUXILIARY CONTACTS UNLESS INDICATED OTHERWISE.
.5 MOUNT IN CSA ENCLOSURE 1 UNLESS OTHERWISE INDICATED.
.6 INCLUDE FOLLOWING OPTIONS IN COVER:
.1 RED INDICATING LAMP.
.2 STOP-START PUSHBUTTON.
.3 HAND-OFF-AUTO SELECTOR SWITCH.
.4 ON-OFF SELECTOR SWITCH.

2.2 EQUIPMENT IDENTIFICATION
.1 PROVIDE EQUIPMENT IDENTIFICATION IN ACCORDANCE WITH SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS.
.2 SIZE 4 NAMEPLATE INDICATING NAME OF LOAD CONTROLLED AS INDICATED.

2.3 ACCEPTABLE MANUFACTURERS
.1 APPROVED MANUFACTURERS ARE CUTLER-HAMMER, SQUARE 'D' CO., ALLEN-BRADLEY CANADA CO., SIEMENS CANADA LTD. AND CANADIAN GENERAL ELECTRIC.

3.1 INSTALLATION
.1 INSTALL CONTACTORS AND CONNECT AUXILIARY CONTROL DEVICES.

16441 - PANEL BOARDS BREAKER TYPE

1.1 SHOP DRAWINGS
.1 SUBMIT SHOP DRAWINGS AND PRODUCT DATA FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.
.2 DRAWINGS TO INCLUDE ELECTRICAL DETAIL OF PANEL, BRANCH BREAKER TYPE, QUANTITY, AMPACITY AND ENCLOSURE DIMENSION.

2.1 PANEL BOARDS
.1 PANEL BOARDS: PRODUCT OF ONE MANUFACTURER.
.1 INSTALL CIRCUIT BREAKERS IN PANEL BOARDS BEFORE SHIPMENT.
.2 IN ADDITION TO CSA REQUIREMENTS MANUFACTURER'S NAMEPLATE MUST SHOW FAULT CURRENT THAT PANEL INCLUDING BREAKERS HAS BEEN BUILT TO WITHSTAND.
.2 250 V PANEL BOARDS: BUS AND BREAKERS RATED FOR 22 KA (SYMMETRICAL) INTERRUPTING CAPACITY.
.3 SEQUENCE PHASE BUSSING WITH ODD NUMBERED BREAKERS ON LEFT AND EVEN ON RIGHT, WITH EACH BREAKER IDENTIFIED BY PERMANENT NUMBER IDENTIFICATION AS TO CIRCUIT NUMBER AND PHASE.
.4 PANEL BOARDS: MAINS, NUMBER OF CIRCUITS, AND NUMBER AND SIZE OF BRANCH CIRCUIT BREAKERS AS INDICATED.
.5 TWO KEYS FOR EACH PANEL BOARD AND KEY PANEL BOARDS ALIKE.
.6 COPPER BUS WITH NEUTRAL OF SAME AMPERE RATING AS MAINS.
.7 MAINS: SUITABLE FOR BOLT-ON BREAKERS.
.8 TRIM WITH CONCEALED FRONT BOLTS AND HINGES.
.9 TRIM AND DOOR FINISH: BAKED GREY ENAMEL.
.10 SURFACE PANEL BOARDS TO BE PROVIDED WITH SPRINKLER DRIP-PROOF HOODS.

2.2 CUSTOM BUILT PANEL BOARD ASSEMBLIES
.1 125 MM RELAY SECTION ON ONE SIDE OF PANELS AS INDICATED FOR INSTALLATION OF LOW VOLTAGE REMOTE CONTROL SWITCHING COMPONENTS.
.2 DOUBLE STACK PANELS AS INDICATED.
.3 CONTACTORS IN MAINS AS INDICATED.
.4 FEED THROUGH LUGS AS INDICATED.
.5 ISOLATED GROUND BUS.

2.3 BREAKERS
.1 BREAKERS: TO SECTION 16412 - MOULDED CASE CIRCUIT BREAKERS.
.2 BREAKERS WITH THERMAL AND MAGNETIC TRIPPING IN PANEL BOARDS EXCEPT AS INDICATED OTHERWISE.
.3 MAIN BREAKER: SEPARATELY MOUNTED ON TOP OR BOTTOM OF PANEL TO SUIT CABLE ENTRY. WHEN MOUNTED VERTICALLY, DOWN POSITION SHOULD OPEN BREAKER.
.4 LOCK-ON DEVICES FOR 10 % OF 15 A BREAKERS INSTALLED AS INDICATED. TURN OVER UNUSED LOCK-ON DEVICES TO OWNER.
.5 LOCK-ON DEVICES FOR FIRE ALARM, CLOCK OUTLET, EMERGENCY LIGHTING, INTERCOM, EXIT AND NIGHT LIGHT CIRCUITS.

2.4 EQUIPMENT IDENTIFICATION
.1 PROVIDE EQUIPMENT IDENTIFICATION IN ACCORDANCE WITH SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS.
.2 NAMEPLATE FOR EACH PANEL BOARD SIZE 4 ENGRAVED AS INDICATED.
.3 NAMEPLATE FOR EACH CIRCUIT IN DISTRIBUTION PANELBOARDS SIZE 2 ENGRAVED AS INDICATED.
.4 COMPLETE CIRCUIT DIRECTORY WITH TYPEWRITTEN LEGEND SHOWING LOCATION AND LOAD OF EACH CIRCUIT.

2.5 ACCEPTABLE MANUFACTURERS
.1 APPROVED MANUFACTURERS ARE CUTLER-HAMMER, SQUARE 'D' CO., SIEMENS CANADA LTD. AND CANADIAN GENERAL ELECTRIC.

3.1 INSTALLATION
.1 LOCATE PANEL BOARDS AS INDICATED AND MOUNT SECURELY, PLUMB, TRUE AND SQUARE, TO ADJOINING SURFACES.
.2 INSTALL SURFACE MOUNTED PANEL BOARDS ON PLYWOOD BACKBOARDS. WHERE PRACTICAL, GROUP PANEL BOARDS ON COMMON BACKBOARD.
.3 MOUNT PANEL BOARDS TO HEIGHT SPECIFIED IN SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS OR AS INDICATED.
.4 CONNECT LOADS TO CIRCUITS.
.5 PROVIDE TWO (2) 1" DIA. SPARE CONDUITS FROM PANEL BOARDS TO CEILING SPACE FOR FUTURE USE.
.6 CONNECT NEUTRAL CONDUCTORS TO COMMON NEUTRAL BUS WITH RESPECTIVE NEUTRAL IDENTIFIED.

16491 - FUSES - LOW VOLTAGE

1.1 PRODUCT DATA
.1 SUBMIT PRODUCT DATA AND SHOP DRAWINGS FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.

1.2 SPARE FUSES
.1 PROVIDE SIX (6) SPARE FUSES OF EACH TYPE AND SIZE INSTALLED UP TO AND INCLUDING 600A.
.2 PROVIDE THREE (3) SPARE FUSES OF EACH TYPE AND SIZE INSTALLED ABOVE 600A.

1.3 DELIVERY AND STORAGE
.1 SHIP FUSES IN ORIGINAL CONTAINERS.
.2 STORE FUSES IN ORIGINAL CONTAINERS IN MOISTURE-FREE LOCATION.
.3 OBTAIN RECEIPT FROM OWNER OF FUSE DELIVERY.

2.1 FUSES - GENERAL
.1 HRC FUSES: TO C.S.A. C22.2 NO. 106 TO HAVE INTERRUPTING CAPABILITY OF 200 KA SYMMETRICAL.
.2 FUSES: PRODUCT OF ONE MANUFACTURER.

2.2 FUSE TYPES
.1 RATINGS OF 1 TO 600 AMPERES: C.S.A. HRC-I,(NON TIME DELAY).
.2 RATINGS OF 601 TO 6000 AMPERES: C.S.A. HRC-L (NON TIME DELAY).
.3 TIME DELAY FUSES (WHERE INDICATED ON DRAWINGS) SHALL CARRY 500% OF RATED CURRENT FOR 10 SECONDS MINIMUM AND BE CLEARLY LABELED "TIME DELAY".
.1 1-600A: HRCI (TIME DELAY)
.2 601-6000A: HRC-L (TIME DELAY)

2.3 APPROVED MANUFACTURERS
.1 BUSSMAN MANUFACTURING
.2 GOULD-SHAWMUT COMPANY

3.1 INSTALLATION
.1 INSTALL FUSES IN MOUNTING DEVICES IMMEDIATELY BEFORE ENERGIZING CIRCUITS.
.2 ENSURE CORRECT FUSES FITTED TO PHYSICALLY-MATCHED MOUNTING DEVICES.
.3 ENSURE CORRECT FUSES TO ASSIGNED ELECTRICAL CIRCUIT.

16505 - LIGHTING EQUIPMENT

1.1 REFERENCES
.1 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
.1 ANSI C82.1-1995, SPECIFICATIONS FOR FLUORESCENT LAMP BALLASTS.
.2 AMERICAN NATIONAL STANDARDS INSTITUTE/INSTITUTE OF ELECTRICAL AND ELECTRONICS (ANSI/IEEE).
.3 ANSI/IEEE C62.41, RECOMMENDED PRACTICES FOR SURGE VOLTAGES IN LOW-VOLTAGE AC POWER CIRCUITS
.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
.1 ASTM F1137, SPECIFICATION FOR PHOSPHATE/OIL AND PHOSPHATE/ORGANIC CORROSION PROTECTIVE COATINGS FOR FASTENERS.
.3 UNITED STATES OF AMERICA, FEDERAL COMMUNICATIONS COMMISSION (FCC)
.1 FCC (CFR47) EM AND RF INTERFERENCE SUPPRESSION.

1.2 SHOP DRAWINGS AND PRODUCT DATA
.1 SUBMIT SHOP DRAWINGS AND PRODUCT DATA FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.
.2 SUBMIT COMPLETE PHOTOMETRIC DATA PREPARED BY INDEPENDENT TESTING LABORATORY FOR LUMINAIRES WHERE SPECIFIED, FOR REVIEW BY ENGINEER.
.3 PHOTOMETRIC DATA TO INCLUDE: VCP TABLE SPACING CRITERION.

2.1 LAMPS
.1 LED LAMPS.
.1 AS SPECIFIED ON THE DRAWINGS.

2.2 DRIVERS
.1 LED DRIVERS:
.1 AS SPECIFIED ON THE DRAWINGS.

2.3 FINISHES
.1 BAKED ENAMEL FINISH:
.1 CONDITIONING OF METAL BEFORE PAINTING:
.1 FOR CORROSION RESISTANCE CONVERSION COATING TO ASTM F 1137.
.2 FOR PAINT BASE, CONVERSION COATING TO ASTM F 1137.
.2 METAL SURFACES OF LUMINAIRE HOUSING AND REFLECTORS FINISHED WITH HIGH GLOSS BAKED ENAMEL TO GIVE SMOOTH, UNIFORM APPEARANCE, FREE FROM PINHOLES OR DEFECTS. PAINT AFTER FORMING.
.3 REFLECTOR AND OTHER INSIDE SURFACES FINISHED AS FOLLOWS:
.1 WHITE, MINIMUM REFLECTION FACTOR 85%.
.2 COLOUR FASTENESS: YELLOWNESS FACTOR NOT ABOVE 0.02 AND AFTER 250 H EXPOSURE IN ATLAS FADE-O-METER NOT TO EXCEED 0.05.
.3 FILM THICKNESS, NOT LESS THAN 0.03 mm AVERAGE AND IN NO AREAS LESS THAN 0.025 mm.
.4 GLOSS NOT LESS THAN 80 UNITS AS MEASURED WITH GARDNER 60° GLOSS METER.
.5 FLEXIBILITY: WITHSTAND BENDING OVER 12 mm MANDREL WITHOUT SHOWING SIGNS OF CRACKING OR FLAKING UNDER 10 TIMES MAGNIFICATION.
.6 ADHESION: 24 mm SQUARE LATTICE MADE OF 3 mm SQUARES CUT THROUGH FILM TO METAL WITH SHARP RAZOR BLADE. ADHESIVE CELLULOSE TAPE APPLIED OVER LATTICE AND PULLED. ADHESION SATISFACTORY IF NO COATING REMOVED.
.2 ALZAK FINISH:
.1 ALUMINUM SHEET FABRICATED FROM SPECIAL ALUMINIUM ALLOYS, CHEMICALLY BRIGHTENED, SUBSEQUENTLY ANODICALLY TREATED TO SPECIFICATIONS ESTABLISHED BY ALCOA, TO PRODUCE:
.1 FINISH FOR MILD COMMERCIAL SERVICE, MINIMUM DENSITY OF COATING 0.8 MG/CM², MINIMUM REFLECTIVITY 83% FOR SPECULAR AND 75% FOR DIFFUSE.
.2 FINISH FOR REGULAR INDUSTRIAL SERVICE, MINIMUM DENSITY OF COATING 1.2 MG/CM², MINIMUM REFLECTIVITY 82% FOR SPECULAR AND 73% FOR DIFFUSE.
.3 FINISH FOR HEAVY DUTY SERVICE, MINIMUM DENSITY OF COATING 1.5 MG/CM², MINIMUM REFLECTIVITY 78% FOR SPECULAR AND 65% FOR DIFFUSE.

2.4 LENSES
.1 LENS DESIGN AS SPECIFIED ON THE DRAWINGS.

2.5 LUMINAIRES
.1 LUMINAIRE DESIGNS AS SPECIFIED ON THE DRAWINGS.

2.6 ACCEPTABLE MANUFACTURERS
.1 SPECIFIED FIXTURES ARE BASE BID.
.2 APPROVED ALTERNATE MANUFACTURES AS INDICATED.

3.1 INSTALLATION
.1 LOCATE AND INSTALL LUMINAIRES AS INDICATED.

3.2 WIRING
.1 CONNECT LUMINAIRES TO LIGHTING CIRCUITS.

3.3 LUMINAIRE SUPPORTS
.1 FOR SUSPENDED CEILING INSTALLATIONS SUPPORT LUMINAIRES INDEPENDENTLY OF CEILING GRID AT BOTH ENDS IN ACCORDANCE WITH LOCAL ELECTRICAL SAFETY AUTHORITY REQUIREMENTS.

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.

3.5 LIGHTING CONTROLS
.1 LIGHTING CONTROLS AS SPECIFIED ON THE DRAWINGS.

3.6 COMMISSIONING
.1 COORDINATE A MEETING BETWEEN ELECTRICAL CONTRACTOR, LIGHTING MANUFACTURER'S REPRESENTATIVE, ENGINEER AND LIGHTING CONSULTANT PRIOR TO PLACING ORDER FOR ANY LIGHTING EQUIPMENT OR LIGHTING SHOP DRAWINGS TO REVIEW EQUIPMENT AND CONTROL SYSTEM COMPONENTS TO BE PROVIDED.
.2 ENGAGE LIGHTING MANUFACTURER'S REPRESENTATIVE OR DESIGNATED AGENT TO PROGRAM, TEST AND COMMISSION ALL LIGHTING CONTROLS TO THE SATISFACTION OF THE ENGINEER AND LIGHTING CONSULTANT.
.3 PROVIDE COMPLETE LIGHTING CONTROLS TESTING, VERIFICATION REPORT AND CERTIFICATION LETTER FROM COMMISSIONING AGENT. INCLUDE COPIES IN ALL PROJECT MANUALS.
.4 FULLY INSTRUCT AND TRAIN OPERATING AND MAINTENANCE PERSONNEL IN CARE, ADJUSTMENT AND OPERATION OF ALL LIGHTING SYSTEMS AND RELATED CONTROLS.

16531 - "RUNNING MAN" EXIT LIGHTING

1.1 REFERENCES
.1 CSA C22.2 NO. 141
.2 CSA C860

1.2 PRODUCT DATA
.1 SUBMIT PRODUCT DATA AND SHOP DRAWINGS FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.

2.1 STANDARD UNITS
.1 HOUSING: EXTRUDED ALUMINUM MINIMUM 1.0 mm THICK.
.2 FACE AND BACK PLATES: BRUSHED ALUMINUM.
.3 LAMPS: LED BAR, AC & DC OPERATION.
.4 OPERATION: DESIGNED FOR 10,000 H OF CONTINUOUS OPERATION WITHOUT RE-LAMPING.
.5 FACEPLATE: "RUNNING MAN" SYMBOL, GREEN ON WHITE GLASS.
.6 DOWN LIGHT: WHITE GLASS TRANSLUCENT ACRYLIC IN BOTTOM OF UNIT.

2.2 SELF-POWERED UNITS
.1 HOUSING: EXTRUDED ALUMINUM MINIMUM 1.0 mm THICK.
.2 FACE AND BACK PLATES: BRUSHED ALUMINUM.
.3 LAMPS: LED BAR, AC & DC OPERATION.
.4 OPERATION: DESIGNED FOR 10,000 H OF CONTINUOUS OPERATION WITHOUT RE-LAMPING.
.5 FACEPLATE: "RUNNING MAN" SYMBOL, GREEN ON WHITE GLASS.
.6 DOWN LIGHT: WHITE GLASS TRANSLUCENT ACRYLIC IN BOTTOM OF UNIT.
.7 SUPPLY VOLTAGE: 120 V, AC.
.8 OUTPUT VOLTAGE: 12 V, DC.
.9 OPERATING TIME: 30 MIN.
.10 RECHARGE TIME: 12 H.
.11 BATTERY: SEALED, MAINTENANCE FREE.
.12 CHARGER: SOLID STATE, VOLTAGE/CURRENT REGULATED, INVERSE TEMPERATURE COMPENSATED, SHORT CIR