ELECTRICAL SPECIFICATIONS - ELECTRICAL CONTRACTOR (1 OF 2)

16000 - ELECTRICAL PROJECT REQUIREMENTS

1.0 SCOPE OF WORK
.1 DIVISION 16 SHALL FURNISH ALL LABOUR, MATERIALS AND EQUIPMENT NECESSARY FOR THE PROPER AND TIMELY COMPLETION OF THE ELECTRICAL SYSTEMS AS SHOWN ON THE DRAWINGS AND/OR AS SPECIFIED.
.2 THE SPECIFICATIONS SHALL BE CONSIDERED AS AN INTEGRAL PART OF THE PLANS THAT ACCOMPANY THEM; NEITHER THE PLANS NOR THE SPECIFICATIONS SHALL BE USED ALONE. ANY ITEMS OR SUBJECT OMITTED FROM ONE, BUT WHICH IS MENTIONED OR REASONABLY IMPLIED IN THE OTHER, SHALL BE CONSIDERED AS PROPERLY AND SUFFICIENTLY SPECIFIED, AND MUST, SHALL NOT RELIEVE THIS DIVISION OF RESPONSIBILITY.
.3 IT IS THE INTENT THAT THE DRAWINGS AND SPECIFICATIONS DESCRIBE COMPLETE ELECTRICAL SYSTEMS. ALL MATERIALS AND EQUIPMENT AND THE FURNISHING OF ALL LABOUR REASONABLY IMPLIED BY THESE DRAWINGS AND/OR THE SPECIFICATIONS SHALL BE INCLUDED TO PROVIDE SYSTEMS READY FOR SATISFACTORY OPERATION. REFER TO ALL OTHER TRADE DRAWINGS AND SPECIFICATIONS TO FULLY CO-ORDINATE THE INSTALLATION OF THE WORK.
.4 FURNISH ALL REQUIRED LABOUR AND MATERIALS, MACHINERY, SCAFFOLDING TOOLS, IMPLEMENTS, OR OTHER APPLIANCES TOGETHER WITH ALL PROPER AND REQUIRED FACILITIES FOR MOVING AND TRANSPORTING SAME, SO THAT THE CONTRACT AND ALL WORK TO BE DONE UNDER IT, CAN AND WILL BE CARRIED ON IN A WORKMANLIKE MANNER, PROPERLY, SATISFACTORILY, CONTINUOUSLY, AND EXPEDITIOUSLY, TO COMPLETION, IN ALL RESPECTS TO THE SATISFACTION OF THE OWNER.

1.2 STANDARD OF ACCEPTANCE
.1 ITEMS ON THE DRAWINGS AND SUBSEQUENT DIVISIONS OF THESE SPECIFICATIONS ARE LISTED WITH THE NAMES OF SPECIFIC MANUFACTURERS, THE FIRST OF WHICH HAS BEEN USED IN THE DESIGN AND IS THE EQUIPMENT SHOWN ON THE DRAWINGS.
.2 THE USE OF ALTERNATE EQUIPMENT WILL REQUIRE THE SUBMISSION OF DETAILED SCALE SHOP DRAWINGS.
.3 ANY ALTERNATE NAMES LISTED IN THIS DIVISION HAVE BEEN SELECTED BECAUSE OF THE SIMILARITY OF QUALITY AND PERFORMANCE. IF THIS SUBCONTRACTOR WISHES TO SUBMIT EQUIPMENT OR MATERIAL OF A MANUFACTURER OTHER THAN THOSE LISTED, APPROVAL MUST BE OBTAINED FROM THE ENGINEER PRIOR TO SUBMISSION OF TENDER. ANY COSTS CAUSED BY THE INSTALLATION OF AN ALTERNATE WILL BE BORNE BY THE CONTRACTOR.
.4 ALL OF THE MATERIALS REQUIRED FOR THE PERFORMANCE OF THE WORK SHALL BE NEW AND THE BEST OF THEIR RESPECTIVE KIND AND OF A UNIFORM PATTERN THROUGHOUT THE WORK.

1.3 CODES, REGULATIONS AND PERMITS
.1 ALL ELECTRICAL WORK SHALL BE INSTALLED, INSPECTED AND TESTED IN ACCORDANCE WITH GOVERNING CODES, RULES AND REGULATIONS OF THE MUNICIPALITY IN WHICH THE WORK IS PERFORMED AND ALSO OF PROVINCIAL AND FEDERAL AUTHORITIES HAVING JURISDICTION.
.2 THE DIVISION 16 CONTRACTOR SHALL OBTAIN ALL PERMITS REQUIRED FOR THE INSTALLATION OF ELECTRICAL WORK, ARRANGE FOR INSPECTIONS AND TESTS AND PAY ALL FEES AND COSTS FOR THE PERMITS AND INSPECTIONS. ALL NECESSARY PERMITS SHALL BE OBTAINED IMMEDIATELY AFTER NOTIFICATION OF AWARD OF CONTRACT.
.3 IN ADDITION TO THE FOREGOING, THE DIVISION 16 CONTRACTOR SHALL PERFORM SUCH OTHER INSPECTIONS AND TESTS AS MAY BE DEEMED NECESSARY BY THE PRIME CONSULTANT.
.4 THE ONTARIO BUILDING CODE AND THE APPLICABLE REQUIREMENTS OF C.S.A., EEMAC, U.L.C., AND NFPA STANDARDS INCLUDING THEIR LATEST AMENDMENTS, AS WELL AS PROVINCIAL AND MUNICIPAL BY-LAWS AND REGULATIONS SHALL BE CONSIDERED PART OF THIS SPECIFICATION. LACK OF POSSESSION OF KNOWLEDGE OF ANY CODE OR STANDARD REQUIRED FOR PROPER COMPLETION OF THE WORK SHALL NOT CONSTITUTE SUFFICIENT REASON FOR DEVIATION THERE FROM.

1.4 RECORD DRAWINGS
.1 CLEARLY RECORD ALL CONTRACT CHANGES AND DEVIATIONS FROM THE CONTRACT DRAWINGS ON A SET OF DRAWINGS AVAILABLE FROM THE GENERAL CONTRACTOR FOR THIS PURPOSE AND FORWARDED TO THE GENERAL CONTRACTOR AT THE COMPLETION OF THE PROJECT.

1.5 SITE VISIT
.1 THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE AND EVALUATE ALL EXISTING SITE CONDITIONS AS THEY MAY AFFECT THIS WORK. NO EXTRAS WILL BE ALLOWED FOR ANY EFFECTS FROM FAILING TO COMPLETE A COMPREHENSIVE SITE TOUR TO UNDERSTAND AND ACCOUNT FOR THE IMPACT OF EXISTING SITE CONDITIONS ON THE CONTRACT SCOPE OF WORK.

1.6 CUTTING AND PATCHING
.1 THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR AND PAY FOR ALL CUTTING AND PATCHING REQUIRED IN THE SCOPE OF WORK AS DEFINED IN THE GENERAL CONDITIONS. ALL NEW FINISHES SHALL BE EQUAL TO THOSE OF SURROUNDING SURFACES FOR MATERIALS, COLOUR, TEXTURE AND WORKMANSHIP. THIS DIVISION SHALL CLEARLY MARK OUT ALL OPENINGS REQUIRED AND REVIEW WITH THE GENERAL CONTRACTOR BEFORE CUTTING PROCEEDS. THIS DIVISION SHALL INSTALL ALL OPENING FRAMES, SLEEVES, CONDUITS, OUTLETS, ETC., INTO THE BUILDING STRUCTURE AS CONSTRUCTION PROGRESSES. ANY ITEMS MISSED DURING CONSTRUCTION THAT MUST BE ADDED WILL BE THE RESPONSIBILITY OF THIS DIVISION AND BE CO-ORDINATED WITH THE GENERAL TRADES.
.2 THE ELECTRICAL CONTRACTOR SHALL SUBMIT TO THE GENERAL CONTRACTORS A COMPLETE INVENTORY OF CUTTING AND PATCHING REQUIREMENTS FOR COMPLETION OF THE SCOPE OF WORK. THIS INVENTORY SHALL BE COMPLETED PRIOR TO TENDER CLOSING TO ALLOW THE GENERAL TRADES TO ASSESS THE WORK REQUIREMENTS.
.3 IN EACH CASE, TRADESMEN QUALIFIED IN THE WORK BEING CUT AND PATCHED SHALL BE EMPLOYED TO ENSURE THAT IT IS CORRECTLY AND NEATLY DONE.
.4 TO COMPLETELY PREVENT THE PASSAGE OF AIR, TIGHTLY FIT ALL CONSTRUCTION TO CONDUITS, ETC. WHICH PASS THROUGH CONSTRUCTION. PAY PARTICULAR ATTENTION WHERE FIRE SEPARATIONS ARE PENETRATED WITH SUCH OBJECTS. BUILD SEPARATIONS TIGHTLY TO MATERIALS PENETRATING SEPARATIONS, OR PROVIDE OTHER MATERIALS FOR PACKING AROUND PERIMETERS, WHICH ARE SPECIFICALLY MANUFACTURED FOR SUCH CONDITIONS. PACKING MATERIALS SHALL BE OF THE EQUIVALENT FIRE RESISTANCE RATING OF THE PENETRATED CONSTRUCTION. OBTAIN CONSULTANT'S APPROVAL PRIOR TO THE USE OF PACKING MATERIALS.

1.7 SHOP DRAWINGS
.1 SHOP DRAWINGS AND DATA SHEETS FOR EQUIPMENT INTENDED FOR INSTALLATION UNDER THIS CONTRACT SHALL BE SUBMITTED FOR REVIEW. AFTER CHECKING AND WHEN REVIEWED, COPIES WILL BE RETURNED TO THE CONTRACTOR.
.2 SAMPLES, DRAWINGS, CATALOGUES, SPECIFICATIONS, ETC. SUBMITTED FOR APPROVAL, SHALL BE PROPERLY LABELED INDICATING SPECIFIED SERVICES FOR WHICH MATERIAL OR EQUIPMENT IS TO BE USED. THE DRAWINGS AND INFORMATION SHALL INDICATE THE PROJECT NAME AND THE ARTICLE NUMBER OF SPECIFICATIONS RELATING TO SHOP DRAWINGS. THE CONTRACTOR'S NAME AND CONTRACTOR'S SIGNATURE SHALL APPEAR ON ALL COPIES INDICATING THAT THE DRAWINGS HAVE BEEN CHECKED BY THE CONTRACTOR. DRAWINGS NOT SO DESIGNATED WILL BE RETURNED FOR CORRECTION. 'FAX' OR ELECTRONIC COPIES OF SHOP DRAWINGS ARE NOT ACCEPTABLE.
.3 INCORPORATE ONLY DIMENSIONAL SYSTEM UTILIZED FOR DRAWINGS. MAKE SOFT CONVERSIONS FROM METRIC SYSTEM TO IMPERIAL, OR VICE VERSA, WHEN REQUIRED FOR INCORPORATION OF UNITS OF ONE-DIMENSIONAL SYSTEM INTO CONSTRUCTION IN THE OTHER.
.4 SHOW ON SHOP DRAWINGS ALL PERTINENT INFORMATION REQUIRED FOR MATERIALS AND INSTALLATION, AND FOR PROPER INTEGRATION OF THIS INSTALLATION WITH WORK OF OTHERS.
.5 DO NOT PROCEED WITH WORK DEPENDENT ON SHOP DRAWINGS INFORMATION UNTIL FINAL REVIEWED SHOP DRAWINGS HAVE BEEN RETURNED BY THE CONSULTANT.
.6 THE CONTRACTOR IS RESPONSIBLE FOR THE DETAIL DESIGN INTENT AND ERRORS / OMISSIONS, DIMENSIONS, INSTALLATION METHODS, CO-ORDINATION, ETC.

1.8 ARRANGEMENT OF EQUIPMENT
.1 CONCEAL CONDUIT AND WIRING WHEREVER POSSIBLE BY RUNNING IT IN PIPE SPACES, DUCT SHAFTS, CHASES, CEILING SPACES AND FURRED OUT SECTIONS OF WALLS AND COLUMNS. DO NOT RUN CONDUIT EXPOSED IN FINISHED AREAS WITHOUT OBTAINING PERMISSION OF THE ARCHITECT.
.2 DO NOT SCALE THE DRAWINGS FOR EXACT CONDUIT LOCATIONS. COORDINATE LIGHT FIXTURES, FIRE ALARM DEVICES, ETC WITH DIFFUSERS, GRILLES AND OTHER FIXTURES SHOWN. MODIFY AS NECESSARY WITHOUT CHANGING THE INTENT OF THE DESIGN TO AVOID OTHER EQUIPMENT, STRUCTURAL ELEMENTS OR WORK INSTALLED BY OTHER TRADES.

1.9 TESTING
.1 DIVISION 16 SHALL PERFORM TESTS ON ALL ELECTRICAL EQUIPMENT AND SYSTEMS AS OUTLINED IN VARIOUS SECTIONS OF THESE SPECIFICATIONS AND SHALL PROVIDE ALL NECESSARY TEST EQUIPMENT AS REQUIRED.

1.10 MECHANICAL EQUIPMENT AND CONTROLS
.1 SUPPLIER AND INSTALLER RESPONSIBILITY IS INDICATED IN THE EQUIPMENT SCHEDULE ON MECHANICAL DRAWINGS.
.2 CONTROL WIRING: ALL CONTROL DEVICES, CONDUIT AND CONNECTIONS BELOW 50V WHICH ARE RELATED TO CONTROL SYSTEMS, ARE A NECESSARY COMPONENT OF THE CONTROL SYSTEM SPECIFIED IN DIVISION 15 OR SHOWN ON MECHANICAL DRAWINGS SHALL BE INSTALLED BY DIVISION 15. REVIEW THE MECHANICAL CONTROL SPECIFICATIONS DIVISIONS 15900 AND 15920.

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS
.1 SUPPLY CERTIFIED PERSONNEL TO INSTRUCT OWNERS OPERATING STAFF ON OPERATION OF ELECTRICAL EQUIPMENT. SUPPLY MAINTENANCE SPECIALIST PERSONNEL TO INSTRUCT OPERATING STAFF ON MAINTENANCE AND ADJUSTMENT OF ELECTRICAL EQUIPMENT AND ANY CHANGES OR MODIFICATIONS IN EQUIPMENT MADE UNDER THE TERMS OF THE GUARANTEE. PROVIDE INSTRUCTION TO OWNERS STAFF DURING REGULAR WORK HOURS PRIOR TO ACCEPTANCE OF THE SYSTEMS FOR REGULAR OPERATION.
.2 UTILIZE THE OPERATION AND MAINTENANCE DATA MANUAL FOR INSTRUCTION PURPOSES. ON COMPLETION OF INSTRUCTIONS, TURN ONE MANUAL OVER TO THE ENGINEER FOR REVIEW AND ACCEPTANCE. PROVIDE THREE (3) COPIES OF OPERATION AND MAINTENANCE MANUALS TO OWNER. THE MAINTENANCE MANUALS SHALL INCLUDE A COMPREHENSIVE OPERATING SECTION, WHICH WILL INCLUDE A DETAILED DESCRIPTION OF ALL ELECTRICAL EQUIPMENT OPERATION INCLUDED WITHIN THIS CONTRACT. THE MAINTENANCE AND OPERATING INSTRUCTIONS WILL BE ASSEMBLED BY THE CONTRACTOR INTO THREE (3) VOLUMES USING SUITABLE LOOSE-LEAF BINDERS AND INCLUDING A COMPLETE INDEX OF CONTENTS. THE INDEX SHALL BE ORGANIZED INTO SECTIONS ACCORDING TO THE NUMERICAL SPECIFICATION SECTIONS.
.3 THE OPERATING INSTRUCTIONS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING INFORMATION, WHICH SHALL BE INCLUDED IN THE MANUALS.
.1 LIST OF RECOMMENDED SPARE PARTS AND QUANTITIES TO BE STOCKED.
.2 COMPLETE PARTS LIST GIVING MANUFACTURER'S NAME AND CATALOGUE NUMBER.
.3 OPERATING INSTRUCTIONS AND PROCEDURES, INCLUDING START UP AND SHUT DOWN PROCEDURE.
.4 MAINTENANCE PROCEDURE INCLUDING PREVENTATIVE MAINTENANCE INSTRUCTIONS.
.5 WIRING DIAGRAM OF CONTROL PANELS.
.4 OPERATION DATA TO INCLUDE:
.1 DESCRIPTION OF EACH SYSTEM AND ITS CONTROLS.
.2 DESCRIPTION OF OPERATION OF EACH SYSTEM AT VARIOUS LOADS.
.3 OPERATION INSTRUCTION FOR EACH SYSTEM AND EACH COMPONENT.
.4 DESCRIPTION OF ACTIONS TO BE TAKEN IN EVENT OF EQUIPMENT FAILURE.

1.12 BUILDING STRUCTURE / EQUIPMENT SUPPORTS
.1 INITIATE NO DRILLING, CUTTING OR WELDING OF THE BUILDING STEEL OR CONCRETE CONSTRUCTION FOR THE PURPOSE OF SUPPORTING MATERIALS OR EQUIPMENT WITHOUT PRIOR APPROVAL OF THE PRIME CONSULTANT.
.2 HANGERS TO STEEL SHALL BE BEAM CLAMPS OR FLANGE HANGERS WHERE POSSIBLE. WHERE ATTACHMENT IS PERMITTED, WELDING STUDS OF A SIZE NOT LARGER THAN 13mm DIAMETER MAY BE USED. IF LARGER SIZE BOLTS ARE REQUIRED TO SUPPORT THE EQUIPMENT, THESE SHALL BE ATTACHED BY STEEL CLIPS OR BRACKETS.
.3 EQUIPMENT SUPPORTS SUPPLIED BY EQUIPMENT MANUFACTURERS.
.4 FLOOR MOUNTED ELECTRICAL EQUIPMENT SUCH AS SWITCHBOARDS AND TRANSFORMERS SHALL BE INSTALLED ON A 100mm (4") HIGH CONCRETE HOUSEKEEPING PAD BY THIS DIVISION
.5 EQUIPMENT SUPPORTS NOT SUPPLIED BY EQUIPMENT MANUFACTURER: FABRICATE FROM STRUCTURAL GRADE STEEL TO CSA STANDARD REFERENCE IN G40.21.

1.13 PROTECTION
.1 ALL ELECTRICAL ITEMS AND EQUIPMENT ON SITE DURING AND FOLLOWING INSTALLATION SHALL BE PROTECTED FROM WEATHER AND OTHER HAZARDS AND MAINTAINED IN AN ORDERLY MANNER. ALL EQUIPMENT INCLUDING LIGHT FIXTURES SHALL BE PROTECTED FROM CONSTRUCTION DUST AND DIRT. PROTECT OUTLETS BOXES FROM DAMAGE AND FROM THE INTRUSION OF FOREIGN MATTER.

1.14 FIRE-STOPPING
.1 WHERE CONDUITS PASS THROUGH FIRE RATED WALLS, FLOORS AND PARTITIONS, PACK SPACE WITH MATERIALS HAVING APPROVAL OF AUTHORITIES HAVING JURISDICTION.
.2 DIVISION 16 TO PROVIDE ALL MATERIALS AND LABOUR TO COMPLETE U.L.C. FIRE-STOPPING FOR DIVISION 16 WORK.

1.15 CO-ORDINATION
.1 START WORK AND PROCEED AS SOON AS POSSIBLE AFTER THE CONTRACT HAS BEEN LET AND IN ACCORDANCE WITH THE CONSTRUCTION OF THE BUILDING.
.2 CONFER AND COOPERATE WITH OTHER TRADES IN ORDER TO ELIMINATE ANY UNNECESSARY DELAYS TO THE CONSTRUCTION SCHEDULE. WHERE DOUBT EXISTS REGARDING OTHER TRADES, CONFER WITH THE SUPERINTENDENT WITHOUT DELAY FOR DETAILED INSTRUCTIONS CONCERNING HOW TO PROCEED WITH THE WORK. EXPEDITE DELIVERY OF ALL EQUIPMENT AND MATERIALS TO MEET THE CONSTRUCTION SCHEDULE.
.3 IDENTIFY AND RESOLVE INTERFERENCE PROBLEMS PRIOR TO INSTALLATION OF EQUIPMENT. SUBMIT INTERFERENCE DRAWINGS FOR REVIEW BY CONSULTANT.
.4 EXAMINE THE SITE AND ALL CONTRACT DOCUMENTS PRIOR TO BID SUBMISSION. NO ALLOWANCE WILL BE MADE BY ANY DIFFICULTIES ENCOUNTERED DUE TO ANY FEATURES OF THE BUILDING, METHODS OF CONSTRUCTION, SITE OR SURROUNDING PUBLIC AND PRIVATE PROPERTY WHICH EXISTED UP TO THE BID CLOSE.

1.16 CO-ORDINATION DRAWINGS
.1 PRIOR TO COMMENCEMENT OF WORK, SUBMIT FOR CONSULTANT REVIEW, CONDUIT AND EQUIPMENT INTERFERENCE DRAWINGS FOR EACH FLOOR LEVEL AND FOR ALL DIVISION 16 WORK. DRAWINGS MUST BE COORDINATED AND CERTIFIED CORRECT FOR REVIEW.
.2 COORDINATION DRAWINGS SHALL BE TO A SCALE SUFFICIENT TO SHOW THE NECESSARY DETAILS. SUBMIT FOR REVIEW, USING THE SAME PROCEDURES AS SPECIFIED FOR SHOP DRAWINGS.
.3 PREPARE DRAWINGS IN CONJUNCTION WITH OTHER DIVISIONS ESPECIALLY DIVISION 15.
.4 DIMENSION PROPOSED LOCATION OF DIVISION 16 WORK WITH RESPECT TO BUILDING ELEVATIONS AND ESTABLISHED GRID LINES.
.5 BASE INFORMATION USED TO PREPARE DRAWINGS ON REVIEWED SHOP DRAWINGS.

1.17 GUARANTEE / WARRANTY
.1 REFER TO GENERAL CONDITIONS. ANY EXTENDED WARRANTIES FOR EQUIPMENT / WORK ON THIS DIVISION SHALL BE NOTED IN SUBSEQUENT SECTIONS.

1.18 COMMISSIONING
.1 ENSURE THAT ALL EQUIPMENT AND SYSTEMS ARE OPERABLE AND SAFE FOR NORMAL OPERATION. ALL TESTING, ADJUSTING, BALANCING AND RECORD KEEPING SHALL BE PERFORMED PRIOR TO COMMISSIONING. OPERATIONAL TESTS ON EQUIPMENT, AND SYSTEMS SHALL BE PERFORMED PRIOR TO COMMISSIONING TO VERIFY THAT THEY MEET DESIGN REQUIREMENTS.
.2 USE QUALIFIED PERSONNEL TO COMMISSION ELECTRICAL EQUIPMENT AND SYSTEMS.
.3 ENSURE AND CERTIFY THE FOLLOWING DOCUMENTS ARE COMPLETE AND CORRECT:
.1 SHOP DRAWINGS AND PRODUCT DATA.
.2 TEST REPORTS.
.3 VERIFICATION REPORTS AND CERTIFICATES.
.4 OPERATION AND MAINTENANCE MANUALS.
.5 AS-BUILT DRAWINGS.
.4 FULLY INSTRUCT AND TRAIN OPERATING AND MAINTENANCE PERSONNEL IN CARE, ADJUSTMENT AND OPERATION OF ELECTRICAL SYSTEMS.

16010 - ELECTRICAL GENERAL REQUIREMENTS

1.2 CODES AND STANDARDS
.1 DO COMPLETE INSTALLATION IN ACCORDANCE WITH CSA C22.1 EXCEPT WHERE SPECIFIED OTHERWISE.
.2 ABBREVIATIONS FOR ELECTRICAL TERMS: TO CSA Z85.

1.3 CARE, OPERATION AND START-UP
.1 INSTRUCT OPERATING PERSONNEL IN THE OPERATION, CARE AND MAINTENANCE OF EQUIPMENT.
.2 ARRANGE AND PAY FOR SERVICES OF MANUFACTURER'S FACTORY SERVICE ENGINEER TO SUPERVISE START-UP OF INSTALLATION, 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 ALL ASPECTS OF ITS CARE AND OPERATION.

1.4 VOLTAGE RATINGS
.1 OPERATING VOLTAGES: TO CAN3-C235.
.2 MOTORS, ELECTRIC HEATING, CONTROL AND DISTRIBUTION DEVICES AND EQUIPMENT TO OPERATE SATISFACTORILY AT 60 HZ WITHIN NORMAL OPERATING LIMITS ESTABLISHED BY ABOVE STANDARD. EQUIPMENT TO OPERATE IN EXTREME OPERATING CONDITIONS ESTABLISHED IN ABOVE STANDARD WITHOUT DAMAGE TO EQUIPMENT.

1.5 PERMITS, FEES AND INSPECTION
.1 SUBMIT TO ELECTRICAL SAFETY AUTHORITY AND SUPPLY AUTHORITY NECESSARY NUMBER OF DRAWINGS AND SPECIFICATIONS FOR EXAMINATION AND APPROVAL PRIOR TO COMMENCEMENT OF WORK.
.2 PAY ASSOCIATED FEES.
.3 ENGINEER WILL PROVIDE DRAWINGS AND SPECIFICATIONS REQUIRED BY ELECTRICAL SAFETY AUTHORITY AND SUPPLY AUTHORITY AT NO COST.
.4 NOTIFY ENGINEER OF CHANGES REQUIRED BY ELECTRICAL SAFETY AUTHORITY PRIOR TO MAKING CHANGES.
.5 FURNISH CERTIFICATES OF ACCEPTANCE FROM ELECTRICAL SAFETY AUTHORITY AND ALL OTHER AUTHORITIES HAVING JURISDICTION ON COMPLETION OF WORK TO ENGINEER.

1.7 MATERIALS AND EQUIPMENT
.1 PROVIDE MATERIALS AND EQUIPMENT AS SHOWN ON THE DRAWINGS AND/OR AS SPECIFIED HEREIN.
.2 EQUIPMENT AND MATERIAL TO BE CSA CERTIFIED. WHERE THERE IS NO ALTERNATIVE TO SUPPLYING EQUIPMENT WHICH IS NOT CSA CERTIFIED, OBTAIN SPECIAL APPROVAL FROM ELECTRICAL SAFETY AUTHORITY.
.3 FACTORY ASSEMBLE CONTROL PANELS AND COMPONENT ASSEMBLIES.

1.8 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS
.1 SUPPLIER AND INSTALLER RESPONSIBILITY IS INDICATED IN MOTOR, CONTROL AND EQUIPMENT SCHEDULE ON ELECTRICAL DRAWINGS AND RELATED MECHANICAL RESPONSIBILITY IS INDICATED ON MECHANICAL EQUIPMENT SCHEDULE ON MECHANICAL DRAWINGS.
.2 CONTROL WIRING AND CONDUIT IS SPECIFIED IN SECTION 16000.

1.9 FINISHES
.1 SHOP FINISH METAL ENCLOSURE SURFACES BY APPLICATION OF RUST RESISTANT PRIMER INSIDE AND OUTSIDE, AND AT LEAST TWO COATS OF FINISH ENAMEL.
.1 PAINT OUTDOOR ELECTRICAL EQUIPMENT "EQUIPMENT GREEN" FINISH TO 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 AND PRIME EXPOSED NON-GALVANIZED HANGERS, RACKS AND FASTENINGS TO PREVENT RUSTING.

1.10 EQUIPMENT IDENTIFICATION
.1 IDENTIFY ELECTRICAL EQUIPMENT WITH NAMEPLATES AND LABELS AS FOLLOWS:
.2 NAMEPLATES:
.1 LAMICOID 1/8" (3mm) THICK PLASTIC ENGRAVING SHEET, WHITE FACE, BLACK CORE, MECHANICALLY ATTACHED WITH SELF TAPPING SCREWS.

NAMEPLATE SIZES	
SIZE 110 X 50 mm 1 LINE	3 mm HIGH LETTERS
SIZE 212 X 70 mm 1 LINE	5 mm HIGH LETTERS
SIZE 312 X 70 mm 2 LINES	3 mm HIGH LETTERS
SIZE 420 X 90 mm 1 LINE	8 mm HIGH LETTERS
SIZE 520 X 90 mm 2 LINES	5 mm HIGH LETTERS
SIZE 625 X 100 mm 1 LINE	12 mm HIGH LETTERS
SIZE 725 X 100 mm 2 LINES	6 mm HIGH LETTERS

.3 LABELS:
.1 EMBOSSED PLASTIC LABELS WITH ¼" (6 mm) HIGH LETTERS UNLESS SPECIFIED OTHERWISE.
.4 WORDING ON NAMEPLATES AND LABELS TO BE APPROVED BY ENGINEER PRIOR TO MANUFACTURE.
.5 ALLOW FOR AVERAGE OF TWENTY-FIVE (25) LETTERS PER NAMEPLATE AND LABEL.
.6 IDENTIFICATION TO BE ENGLISH.
.7 USE ONE NAMEPLATE OR LABEL FOR EACH LANGUAGE.
.8 NAMEPLATES FOR TERMINAL CABINETS AND JUNCTION BOXES TO INDICATE SYSTEM AND/OR VOLTAGE CHARACTERISTICS.
.9 IDENTIFY EQUIPMENT WITH SIZE 3 LABELS ENGRAVED AS DIRECTED BY ENGINEER.
.10 DISCONNECTS, STARTERS AND CONTACTORS: INDICATE EQUIPMENT BEING CONTROLLED AND VOLTAGE.
.11 TERMINAL CABINETS AND PULL BOXES: INDICATE SYSTEM AND VOLTAGE.
.12 TRANSFORMERS: INDICATE CAPACITY, PRIMARY AND SECONDARY VOLTAGES.
.13 RECEPTACLES: INDICATE SUPPLY PANELBOARD AND BREAKER NUMBER.

1.11 WIRING IDENTIFICATION
.1 IDENTIFY WIRING WITH PERMANENT INDELIBLE IDENTIFYING MARKINGS, EITHER NUMBERED OR COLOURED PLASTIC TAPES, ON BOTH ENDS OF PHASE CONDUCTORS OF FEEDERS AND BRANCH CIRCUIT WIRING.
.2 MAINTAIN PHASE SEQUENCE AND COLOUR CODING THROUGHOUT.
.3 COLOUR CODE: TO CSA C22.1.
.4 USE COLOUR CODED WIRES IN COMMUNICATION CABLES, MATCHED THROUGHOUT SYSTEM.

1.12 CONDUIT AND CABLE IDENTIFICATION
.1 COLOUR CODE CONDUITS, BOXES AND METALLIC SHEATHED CABLES.
.2 CODE WITH PLASTIC TAPE OR PAINT AT POINTS WHERE CONDUIT OR CABLE ENTERS WALL, CEILING, OR FLOOR, AND AT 50' (15 M) INTERVALS.
.3 COLORS: 1" (25 mm) WIDE PRIME COLOR AND ¾" (20 mm) WIDE AUXILIARY COLOUR.

SERVICE	PRIME	AUXILIARY
UP TO 250 V	YELLOW	
UP TO 600 V	BROWN	GREEN
UP TO 15 KV	ORANGE	BLUE
TELEPHONE	GREEN	
OTHER COMMUNICATION SYSTEMS	PURPLE	BLUE
FIRE ALARM	RED	

1.13 WIRING TERMINATIONS
.1 LUGS, TERMINALS, SCREWS USED FOR TERMINATION OF WIRING TO BE SUITABLE FOR EITHER COPPER OR ALUMINIUM CONDUCTORS.

1.14 MANUFACTURERS AND CSA LABELS
.1 VISIBLE AND LEGIBLE AFTER EQUIPMENT IS INSTALLED.

1.15 WARNING SIGNS
.1 AS SPECIFIED AND TO MEET REQUIREMENTS OF ELECTRICAL SAFETY AUTHORITY AND CONSULTANT.
.2 PORCELAIN ENAMEL SIGNS, MINIMUM SIZE 6" X 10" (175 X 250 mm).

1.16 SINGLE LINE ELECTRICAL DIAGRAMS
.1 PROVIDE SINGLE LINE ELECTRICAL DIAGRAMS UNDER PLEXIGLASS AS FOLLOWS:
.1 ELECTRICAL DISTRIBUTION SYSTEM: LOCATE IN MAIN ELECTRICAL ROOM.
.2 PROVIDE FIRE ALARM RISER DIAGRAM, PLAN AND ZONING OF BUILDING UNDER PLEXIGLASS AT FIRE ALARM CONTROL PANEL AND ANNUNCIATOR(S).
.3 DRAWINGS: 24" X 24" (600 X 600 mm) MINIMUM SIZE.

1.17 LOCATION OF OUTLETS
.1 LOCATE OUTLETS AS SHOWN ON THE DRAWINGS AND IN ACCORDANCE WITH GENERAL INSTRUCTIONS.
.2 DO NOT INSTALL OUTLETS BACK-TO-BACK IN WALL; ALLOW MINIMUM 6" (150 mm) HORIZONTAL CLEARANCE BETWEEN BOXES.
.3 CHANGE LOCATION OF OUTLETS AT NO EXTRA COST OR CREDIT, PROVIDING DISTANCE DOES NOT EXCEED 10' (3000 mm) AND INFORMATION IS GIVEN BEFORE INSTALLATION.
.4 LOCATE LIGHT SWITCHES ON LATCH SIDE OF DOORS. LOCATE DISCONNECT DEVICES IN MECHANICAL AND ELEVATOR MACHINE ROOMS ON LATCH SIDE OF DOOR.

1.18 MOUNTING HEIGHTS
.1 MOUNTING HEIGHT OF EQUIPMENT IS FROM FINISHED FLOOR TO CENTRELINE OF EQUIPMENT UNLESS SPECIFIED OR INDICATED OTHERWISE.
.2 IF MOUNTING HEIGHT OF EQUIPMENT IS NOT SPECIFIED OR INDICATED, VERIFY BEFORE PROCEEDING WITH INSTALLATION.
.3 INSTALL ELECTRICAL EQUIPMENT AT FOLLOWING HEIGHTS UNLESS INDICATED OTHERWISE.
.1 LOCAL SWITCHES: 48" (1200 mm)
.2 WALL RECEPTACLES:
.1 GENERAL: 18" (455 mm).
.2 ABOVE TOP OF CONTINUOUS BASEBOARD HEATER: 8" (200 mm).
.3 ABOVE TOP OF COUNTERS OR COUNTER SPLASH BACKS: 6" (150 mm).
.4 IN MECHANICAL ROOMS: 48" (1200 mm).
.3 PANELBOARDS: AS REQUIRED BY CODE: 6' (1800 mm) TO TOP
.4 TELEPHONE AND INTERPHONE OUTLETS: 18" (455 mm).
.5 WALL MOUNTED TELEPHONE AND INTERPHONE OUTLETS: 54" (1370 mm).
.6 FIRE ALARM PULL STATIONS: 48" (1200 mm).
.7 FIRE ALARM BELLS AND HORNS: 7' (2100 mm).
.8 FIRE ALARM ANNUNCIATOR PANEL: 5' (1525 mm).
.9 P/A SPEAKER / CALL-STATIONS: 54" (1370 mm).
.10 DATA OUTLETS: 18" (455 mm).

1.19 LOAD BALANCE
.1 MEASURE PHASE CURRENT TO PANEL BOARDS WITH NORMAL LOADS (LIGHTING) OPERATING AT TIME OF ACCEPTANCE. ADJUST BRANCH CIRCUIT CONNECTIONS AS REQUIRED TO OBTAIN BEST BALANCE OF CURRENT BETWEEN PHASES AND RECORD CHANGES.
.2 MEASURE PHASE VOLTAGES AT LOADS AND ADJUST TRANSFORMER TAPS TO WITHIN 2% OF RATED VOLTAGE OF EQUIPMENT.
.3 SUBMIT, AT COMPLETION OF WORK, REPORT LISTING PHASE AND NEUTRAL CURRENTS ON PANEL BOARDS, DRY-CORE TRANSFORMERS AND MOTOR CONTROL CENTRES, OPERATING UNDER NORMAL LOAD. STATE HOUR AND DATE ON WHICH EACH LOAD WAS MEASURED, AND VOLTAGE AT TIME OF TEST.

1.20 CONDUIT AND CABLE INSTALLATION
.1 INSTALL CONDUIT AND SLEEVES PRIOR TO POURING OF CONCRETE. SLEEVES THROUGH CONCRETE: SCHEDULE 40 STEEL PIPE, SIZED FOR FREE PASSAGE OF CONDUIT, AND PROTRUDING 4" (100 mm).
.2 IF PLASTIC SLEEVES ARE USED IN FIRE RATED WALLS OR FLOORS, REMOVE BEFORE CONDUIT INSTALLATION.
.3 INSTALL CABLES, CONDUITS AND FITTINGS TO BE EMBEDDED OR PLASTERED OVER, NEATLY AND CLOSE TO BUILDING STRUCTURE SO FURRING CAN BE KEPT TO MINIMUM.

1.21 FIELD QUALITY CONTROL
.1 CONDUCT AND PAY FOR FOLLOWING TESTS:
.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, HEATERS AND ASSOCIATED CONTROL EQUIPMENT INCLUDING SEQUENCED OPERATION OF SYSTEMS WHERE APPLICABLE.
.5 SYSTEMS: FIRE ALARM SYSTEM, EMERGENCY/EXIT LIGHTING SYSTEM, P/A SYSTEM.
.2 FURNISH MANUFACTURER'S CERTIFICATE OR LETTER CONFIRMING THAT ENTIRE INSTALLATION AS IT PERTAINS TO EACH SYSTEM HAS BEEN INSTALLED TO MANUFACTURER'S INSTRUCTIONS.
.3 INSULATION RESISTANCE TESTING.
.1 MEGGER CIRCUITS, FEEDERS AND EQUIPMENT UP TO 350 V WITH A 500 V INSTRUMENT.
.2 MEGGER 350-600 V CIRCUITS, FEEDERS AND EQUIPMENT WITH A 1000 V INSTRUMENT.
.3 CHECK RESISTANCE TO GROUND BEFORE ENERGIZING.
.4 CARRY OUT TESTS IN PRESENCE OF ENGINEER.
.5 PROVIDE INSTRUMENTS, METERS, EQUIPMENT AND PERSONNEL REQUIRED TO CONDUCT TESTS DURING AND AT CONCLUSION OF PROJECT.
.6 SUBMIT TEST RESULTS FOR ENGINEER'S REVIEW.

1.22 CO-ORDINATION OF PROTECTIVE DEVICES
.1 ENSURE CIRCUIT PROTECTIVE DEVICES SUCH AS OVERCURRENT TRIPS, RELAYS AND FUSES ARE INSTALLED TO REQUIRED VALUES AND SETTINGS.

1.23 COMMISSIONING AND STARTUP
.1 ENSURE THAT ALL EQUIPMENT AND SYSTEMS ARE TESTED ADJUSTED, OPERABLE AND SAFE PRIOR TO START-UP.
.2 PROVIDE QUALIFIED PERSONNEL AND EQUIPMENT TO ASSIST EQUIPMENT MANUFACTURERS AND OTHERS DURING COMMISSIONING AND START-UP.
.3 COORDINATE WITH DIVISION 15 REQUIREMENTS AND FORCES.

16062 - GROUNDING SECONDARY

2.1 EQUIPMENT
.1 CLAMPS FOR GROUNDING OF CONDUCTOR, SIZE AS REQUIRED TO ELECTRICALLY CONDUCTIVE UNDERGROUND METALLIC WATER PIPE.
.2 COPPER CONDUCTOR AT LEAST BARE, STRANDED, SOFT ANNEALED, SIZE AS INDICATED OR REQUIRED.
.3 INSULATED GROUNDING CONDUCTORS: TYPE RW90.
.4 GROUND BUS: COPPER, SIZE 50mm BY 2mm AS INDICATED, SUPPORTS, FASTENINGS, CONNECTORS.
.5 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 MANUFACTURERS: BURNDY

3.1 INSTALLATION
.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 AUTHORITIES HAVING JURISDICTION OVER INSTALLATION. WHERE EMT IS USED, RUN 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 CONDUCTIVE WATER MAIN, ELECTRODES, AND STEEL STRUCTURE, USING COPPER WELDING BY THERMIT PROCESS, CADWELD TYPE.
.5 USE MECHANICAL CONNECTORS FOR GROUNDING CONNECTIONS TO EQUIPMENT PROVIDED WITH LUGS.
.6 SOLDERED JOINTS ARE NOT PERMITTED.
.7 INSTALL BONDING WIRE FOR FLEXIBLE CONDUIT, CONNECTED AT ONE END TO GROUNDING BUSHING, SOLDER LESS LUG, CLAMP OR CUP WASHER AND SCREW. NEATLY CLEAT BONDING WIRE TO EXTERIOR OF FLEXIBLE CONDUIT.
.8 INSTALL FLEXIBLE GROUND STRAPS FOR BUS DUCT ENCLOSURE JOINTS, WHERE SUCH BONDING IS NOT INHERENTLY PROVIDED WITH EQUIPMENT.
.9 INSTALL SEPARATE GROUND CONDUCTOR TO OUTDOOR LIGHTING STANDARDS.
.10 GROUND SECONDARY SERVICE PEDESTALS.

3.2 SYSTEM AND CIRCUIT GROUNDING
.1 INSTALL SYSTEM AND CIRCUIT GROUNDING CONNECTIONS TO NEUTRAL OF 208V AND 600V SYSTEMS AS REQUIRED.

3.3 EQUIPMENT GROUNDING
.1 INSTALL GROUNDING CONNECTIONS TO TYPICAL EQUIPMENT INCLUDED IN, BUT NOT NECESSARILY LIMITED TO THE FOLLOWING: SERVICE EQUIPMENT, TRANSFORMERS, SWITCHGEAR, DUCT SYSTEMS, FRAMES OF MOTORS, MOTOR CONTROL CENTRES, STARTERS, CONTROL PANELS, BUILDING STEEL WORK, GENERATORS, ELEVATORS AND ESCALATORS, DISTRIBUTION PANELS, OUTDOOR LIGHTING.

3.4 COMPUTER EQUIPMENT ISOLATED GROUNDING
.1 COMPUTER GROUNDING CONDUCTORS: COPPER, CONTINUOUS, INSULATED, COLOURED GREEN INSTALLED IN CONDUIT.
.2 GROUND BUSES IN DISTRIBUTION PANELS: ISOLATED FROM FRAME.
.3 GROUNDING CONDUCTORS, SIZE EQUAL TO COMPUTER POWER PHASE CONDUCTORS, FROM COMPUTER ROOM BRANCH CIRCUIT DISTRIBUTION PANEL GROUND BUS, TO COMPUTER EQUIPMENT VIA CONDUIT AND POWER CORD.
.4 GROUNDING CONDUCTOR, SIZE AS INDICATED, FROM EACH COMPUTER ROOM BRANCH CIRCUIT DISTRIBUTION PANEL GROUNDING BUS TO MAIN DISTRIBUTION PANEL GROUNDING BUS.

3.5 COMMUNICATION SYSTEMS
.1 INSTALL GROUNDING CONNECTIONS FOR TELEPHONE, SOUND, FIRE ALARM, SECURITY, INTERCOMMUNICATION SYSTEMS AS FOLLOWS:
.1 TELEPHONE: MAKE TELEPHONE GROUNDING SYSTEM IN ACCORDANCE WITH TELEPHONE COMPANY'S REQUIREMENTS.
.2 SOUND, FIRE ALARM, SECURITY, INTERCOMMUNICATION SYSTEMS AS REQUIRED.

3.6 TESTS
.1 PERFORM TESTS IN ACCORDANCE WITH SECTION 16010.
.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 DISCONNECT GROUND FAULT INDICATOR DURING TESTS.

16070 - SEISMIC RESTRAINT SYSTEMS

1.1 DEFINITION
.1 SRS: ACRONYM FOR SEISMIC RESTRAINT SYSTEM.
.2 THIS SPECIFICATION INCLUDES FOR THE PROFESSIONAL ENGINEERING DESIGN AND THE SUPPLY AND INSTALLATION OF SEISMIC RESTRAINT SYSTEMS FOR ALL STATICALLY SUPPORTED AND VIBRATION ISOLATED ELECTRICAL EQUIPMENT AND SYSTEMS INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
.1 SWITCHGEAR
.2 TRANSFORMERS
.3 PANELBOARDS
.4 MOTOR CONTROL CENTRES
.5 CABLE TRAY SYSTEMS
.6 SUSPENDED CONDUITS
.7 LIGHTING
.8 FIRE ALARM SYSTEM
.9 COMMUNICATION SYSTEMS
.10 OTHER ELECTRICAL EQUIPMENT AND SYSTEMS

1.2 LIMITATIONS
.1 ONE ONLY TRADE TO BE RESPONSIBLE FOR ALL SEISMIC RESTRAINT SYSTEMS FOR ALL ELECTRICAL SYSTEMS AND EQUIPMENT.

1.3 GENERAL DESCRIPTION
.1 THIS SECTION COVERS DESIGN, SUPPLY AND INSTALLATION OF COMPLETE SRS FOR ALL SYSTEMS, EQUIPMENT SPECIFIED FOR INSTALLATION ON THIS ELECTRICAL PROJECT AS DEFINED IN 1.1.2 ABOVE.
.2 SYSTEMS, EQUIPMENT NOT REQUIRED TO BE OPERATIONAL DURING AND AFTER SEISMIC EVENT.
.3 DURING SEISMIC EVENT, SRS TO PREVENT SYSTEMS AND EQUIPMENT FROM CAUSING PERSONAL INJURY AND FROM MOVING FROM NORMAL POSITION.
.4 DESIGN TO BE BY A PROFESSIONAL ENGINEER SPECIALIZING IN THE DESIGN OF SRS AND REGISTERED IN PROVINCE OF ONTARIO WITH A VALID PEO CERTIFICATE OF AUTHORIZATION.
.5 DESIGN EARTHQUAKE LOAD AND EFFECTS FROM THE NBC 2005 AND OBC 2006.
.6 SRS TO BE FULLY INTEGRATED INTO AND COMPATIBLE WITH THE STRUCTURAL, MECHANICAL AND ELECTRICAL DESIGN OF THE PROJECT.

1.4 REFERENCES
.1 CAN/CSA-G40.21, STRUCTURAL QUALITY STEELS.

1.5 SUBMITTALS
.1 SUBMIT SHOP DRAWINGS AND PRODUCT DATA IN ACCORDANCE WITH GENERAL CONDITIONS.
.2 SUBMITTALS TO INCLUDE:
.1 FULL DETAILS OF DESIGN CRITERIA.
.2 WORKING DRAWINGS (PREPARED TO SAME STANDARD OF QUALITY AND SIZE AS DOCUMENTS FORMING THESE TENDER DOCUMENTS), MATERIALS LISTS, SCHEMATICS FULL SPECIFICATIONS OF ALL COMPONENTS OF EACH SRS TO BE PROVIDED.
.3 DESIGN CALCULATIONS (INCLUDING RESTRAINT LOADS RESULTING FROM SEISMIC FORCES IN ACCORDANCE WITH NATIONAL BUILDING CODE, DETAILED WORK SHEETS, TABLES).
.4 SEPARATE SHOP DRAWINGS FOR EACH STS AND DEVICES FOR EACH SYSTEM, EQUIPMENT.
.5 IDENTIFICATION OF LOCATION OF EACH DEVICE.
.6 SCHEDULES OF TYPES OF SRS EQUIPMENT AND DEVICES.
.7 DETAILS OF FASTENERS AND ATTACHMENTS TO STRUCTURE, ANCHORAGE LOADINGS, ATTACHMENT METHODS.
.8 INSTALLATION PROCEDURES AND INSTRUCTIONS.

1.6 MAINTENANCE DATA
.1 PROVIDE MAINTENANCE DATE INCLUDING MONITORING REQUIREMENTS FOR INCORPORATION INTO MANUALS SPECIFIED IN THE GENERAL CONDITIONS.

2.1 SRS MANUFACTURER
.1 SRS TO BE FROM ONE MANUFACTURER REGULARLY ENGAGED IN PRODUCTION OF SAME.
.2 ACCEPTABLE MATERIALS:
.1 TECOUSTICS
.2 VIBRON
.3 VIBRO-ACOUSTICS
.4 ANVIL

2.2 SRS GENERAL
.1 SRS TO PROVIDE GENTLE AND STEADY CUSHIONING ACTION AND AVOID HIGH IMPACT LOADS.
.2 SRS TO RESTRAIN SEISMIC FORCES IN ALL DIRECTIONS.
.3 FASTENERS AND ATTACHMENT POINTS TO RESIST SAME LOAD AS SEISMIC RESTRAINTS.
.4 SRS OF CONDUIT AND CABLE TRAY SYSTEMS TO BE COMPATIBLE WITH:
.1 EXPANSION, ANCHORING AND GUIDING REQUIREMENTS.
.5 SRS UTILIZING CAST IRON, THREADED PIPE, OTHER BRITTLE MATERIALS NOT PERMITTED.
.6 ATTACHMENTS TO STRUCTURE:
.1 USE HIGH STRENGTH MECHANICAL EXPANSION ANCHORS.
.2 DRILLED OR POWER DRIVEN ANCHORS NOT PERMITTED.
.3 ACCEPTABLE MATERIALS: HILTI TYPE HSL.
.7 SEISMIC CONTROL MEASURES NOT TO INTERFERE WITH INTEGRITY OF FIRESTOPPING.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS
.1 FLOOR MOUNTED EQUIPMENT, SYSTEMS:
.1 ANCHOR EQUIPMENT TO EQUIPMENT SUPPORTS.
.2 ANCHOR EQUIPMENT SUPPORTS TO STRUCTURE.
.3 USE SIZE OF BOLTS SCHEDULED IN APPROVED SHOP DRAWINGS.
.2 SUSPENDED EQUIPMENT, SYSTEMS:
.1 USE ONE OR COMBINATION OF FOLLOWING METHODS:
.1 INSTALL TIGHT TO STRUCTURE.
.2 CROSS-BRACE IN ALL DIRECTIONS.
.3 BRACE BACK TO STRUCTURE.
.4 SLACK CABLE RESTRAINT SYSTEM.
.2 SRS TO PREVENT SWAY IN HORIZONTAL PLANE, "ROCKING" IN VERTICAL PLANE, SLIDING AND BUCKLING IN AXIAL DIRECTION.
.3 HANGER RODS TO WITHSTAND COMPRESSIVE LOADING AND BUCKING

2.4 SLACK CABLE RESTRAINT SYSTEM (SCS)
.1 USE ELASTOMER MATERIALS OR SIMILAR TO AVOID HIGH IMPACT LOADS AND PROVIDE GENTLE AND STEADY CUSHIONING ACTION.
.2 SCS TO PREVENT SWAY IN HORIZONTAL PLANE, "ROCKING" IN VERTICAL PLANE, SLIDING AND BUCKLING IN AXIAL DIRECTION.
.3 HANGER RODS TO WITHSTAND COMPRESSIVE LOADING AND BUCKLING.

3.1 INSTALLATION
.1 ATTACHMENT POINTS AND FASTENERS:
.1 TO WITHSTAND SAME MAXIMUM LOAD THAT SEISMIC RESTRAINT IS TO RESIST AND IN ALL DIRECTIONS.
.2 SLACK CABLE SYSTEMS (SCS):
.1 CONNECT TO SUSPENDED EQUIPMENT SO THAT AXIAL PROJECTION OF WIRE PASSES THROUGH CENTRE OF GRAVITY OF EQUIPMENT.
.2 USE APPROPRIATE GROMMETS, SHACKLES AND OTHER HARDWARE TO ENSURE ALIGNMENT OF RESTRAINTS AND TO AVOID BENDING OF CABLES AT CONNECTION POINTS.
.3 CONDUIT AND CABLE TRAY SYSTEMS: PROVIDE TRANSVERSE SCS AT 10M SPACING MAXIMUM, LONGITUDINAL SCS AT 20 M MAXIMUM OR AS LIMITED BY ANCHOR/SLACK CABLE PERFORMANCE.
.4 ORIENT RESTRAINT WIRES ON CEILING HUNG EQUIPMENT AT APPROXIMATELY 90 DEG. TO EACH OTHER (IN PLAN), TIE BACK TO STRUCTURE AT MAXIMUM OF 45 DEG. TO STRUCTURE.
.5 ADJUST RESTRAINT CABLES SO THAT THEY ARE NOT VISIBLY SLACK BUT PERMIT VIBRATION ISOLATION SYSTEM TO FUNCTION NORMALLY.
.6 TIGHTEN CABLE TO REDUCE SLACK TO 40 mm UNDER THUMB PRESSURE. CABLE NOT TO SUPPORT WEIGHT DURING NORMAL OPERATION.
.3 INSTALL SRS AT LEAST 25 mm FROM ALL OTHER EQUIPMENT, SYSTEMS, SERVICES.
.4 MISCELLANEOUS EQUIPMENT NOT VIBRATION-ISOLATED:
.1 BOLT THROUGH HOUSE-KEEPING PAD TO STRUCTURE.
.5 CO-ORDINATE CONNECTIONS WITH ALL DISCIPLINES.

3.2 INSPECTION AND CERTIFICATION
.1 SRS TO BE INSPECTED AND CERTIFIED BY THE SEISMIC ENGINEER UPON COMPLETION OF INSTALLATION.
.2 PROVIDE WRITTEN REPORT TO THE CONSULTANT WITH CERTIFICATE OF COMPLIANCE.

3.3 COMMISSIONING DOCUMENTATION
.1 UPON COMPLETION AND ACCEPTANCE OF CERTIFICATION, HAND OVER TO THE CONSULTANT COMPLETE SET OF CONSTRUCTION DOCUMENTS, REVISED TO SHOW "AS-BUILT" CONDITIONS.

16071 - FASTENING AND SUPPORTS

2.1 SUPPORT CHANNELS
.1 U SHAPE, SIZE 41 X 41 mm, 2.5 mm THICK, SURFACE MOUNTED SUSPENDED SET IN POURED CONCRETE WALLS AND CEILINGS.

3.1 INSTALLATION
.1 SECURE EQUIPMENT TO SOLID MASONRY, TILE AND PLASTER SURFACES WITH LEAD ANCHORS OR NYLON SHIELDS.
.2 SECURE EQUIPMENT TO POURED CONCRETE WITH EXPANDABLE INSERTS.
.3 SECURE EQUIPMENT TO HOLLOW MASONRY WALLS 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 FASTEN EXPOSED CONDUIT OR CABLES TO BUILDING CONSTRUCTION OR SUPPORT SYSTEM USING STRAPS.
.1 ONE-HOLE MALLEABLE IRON STEEL STRAPS TO SECURE SURFACE CONDUITS AND CABLES 50 mm AND SMALLER.
.2 TWO-HOLE STEEL STRAPS FOR CONDUITS AND CABLES LARGER THAT 50 mm.
.3 BEAM CLAMPS TO SECURE CONDUIT TO EXPOSED STEEL WORK.
.7 SUSPENDED SUPPORT SYSTEMS.
.1 SUPPORT INDIVIDUAL CABLE OR CONDUIT RUNS WITH 6 mm DIA THREADED RODS AND SPRING CLIPS.
.2 SUPPORT 2 OR MORE CABLES OR CONDUITS ON CHANNELS SUPPORTED BY 6 mm DIA THREADED ROD HANGERS WHERE DIRECT FASTENING TO BUILDING CONSTRUCTION IS IMPRACTICAL.
.8 FOR SURFACE MOUNTING OF TWO OR MORE CONDUITS USE CHANNELS.
.9 PROVIDE METAL BRACKETS, FRAMES, HANGERS, CLAMPS AND RELATED TYPES OF SUPPORT STRUCTURES WHERE INDICATED OR AS REQUIRED TO SUPPORT CONDUIT AND CABLE RUNS.
.10 ENSURE ADEQUATE SUPPORT FOR RACEWAYS AND CABLES DROPPED VERTICALLY TO EQUIPMENT WHERE THERE IS NO WALL SUPPORT.
.11 DO NOT USE WIRE LASHING OR PERFORATED STRAP TO SUPPORT OR SECURE RACEWAYS OR CABLES.
.12 DO NOT USE SUPPORTS OR EQUIPMENT INSTALLED FOR OTHER TRADES FOR CONDUIT OR CABLE SUPPORT EXCEPT WITH PERMISSION OF OTHER TRADE AND APPROVAL OF CONSULTANT.
.13 INSTALL FASTENINGS AND SUPPORTS AS REQUIRED FOR EACH TYPE OF EQUIPMENT CABLES AND CONDUITS, AND IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION.
.14 ALL LIGHT FIXTURES INSTALLED IN OR ON T-BAR CEILINGS TO BE INDEPENDENTLY SUPPORTED. USE APPROPRIATE JACK CHAIN AND ANCHORS.

16112 - SURFACE RACEWAY SYSTEM

1.1 PRODUCT DATA
.1 SUBMIT PRODUCT DATA IN ACCORDANCE WITH SECTIONS 16010.
.2 INDICATE TYPES OF RACEWAYS WITH TERMINOLOGY SIMILAR TO THAT USED IN THIS SECTION.

2.1 SURFACE RACEWAY SYSTEM (WIRING LAID IN)
.1 TWO-PIECE, STEEL ASSEMBLY, C/W CENTRE BARRIER.
.2 FINISH: IVORY ENAMEL.
.3 NECESSARY SWITCH, RECEPTACLE, EXTENSION BOXES, ADAPTERS AND UTILITY FITTINGS REQUIRED FOR COMPLETE INSTALLATION.
.4 PREFERRED SUPPLIER: WIREMOLD CAT. NO. V4000 SERIES.

2.2 CHANNEL RACEWAY
.1 CHANNEL TYPE RACEWAY: STEEL, SOLID.

2.3 FITTINGS
.1 ELBOWS, TEES, COUPLINGS AND HANGER FITTINGS: MANUFACTURED AS ACCESSORIES TO RACEWAY SUPPLIED.

2.4 SURFACE RACEWAY SYSTEM (WIRE PULLED IN)
.1 ONE-PIECE STEEL ASSEMBLY FREE OF SHARP EDGES MANUFACTURED SO THAT WIRING IS PULLED INTO RACEWAY.
.2 FINISH: IVORY ENAMEL.
.3 NECESSARY SWITCH, RECEPTACLE, EXTENSION BOXES, ADAPTERS AND UTILITY FITTINGS REQUIRED FOR COMPLETE INSTALLATION.
.4 CORNERS, PULL BOXES, ELBOWS, TEES, TWO-PIECE ASSEMBLY TO FACILITATE SITE WIRING.
.5 CROSS-SECTION DIMENSIONS AS INDICATED.
.6 ACCEPTABLE MANUFACTURERS:
.1 WIREMOLD (NEPCO)

3.1 INSTALLATION
.1 INSTALL RACEWAYS BEFORE INSTALLATION OF WIRING. INSTALL COVERS FOR RACEWAYS AND FITTINGS AFTER INSTALLATION OR WIRING.
.2 INSTALL SUPPORTING BRACKETS, ELBOWS, TEES, CONNECTORS, FITTINGS, BUSHINGS, ADAPTORS AND REQUIRED.
.3 KEEP NUMBER OF ELBOWS, OFFSETS, CONNECTIONS TO MINIMUM.
.4 USE WIRING WITH MECHANICAL PROTECTION IN CHANNEL RACEWAYS.
.5 INSTALL BARRIERS IN RACEWAYS WHERE DIFFERENT VOLTAGE SYSTEMS ARE INDICATED.

16122 - WIRES AND CABLES 0 - 1000V

1.2 REFERENCES
.1 CSA C22.2 NO.0.3-92, TEST METHODS FOR ELECTRICAL WIRES AND CABLES.
.2 CAN/CSA-C22.2 NO.131, TYPE TECK 90 CABLE.

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

2.1 BUILDING WIRES
.1 CONDUCTORS: STRANDED FOR 10 AWG AND LARGER. MINIMUM SIZE: 12 AWG.
.2 COPPER CONDUCTORS: SIZE AS INDICATED, WITH 300 AND 600 V INSULATION OF CHEMICALLY CROSS-LINKED THERMOSETTING POLYETHYLENE MATERIAL RATED RW90.
.3 COPPER CONDUCTORS: SIZE AS INDICATED, WITH THERMOPLASTIC INSULATION TYPE TWH RATED AT 600 V.

2.2 TECK CABLE
.1 CABLE: TO CAN/CSA-C22.2 NO.131.
.2 CONDUCTORS:
.1 GROUNDING CONDUCTOR: COPPER.
.2 CIRCUIT CONDUCTORS: COPPER, SIZE AS INDICATED.
.3 INSULATION:
.1 TYPE: ETHYLENE PROPYLENE RUBBER.
.2 CHEMICALLY CROSS-LINKED THERMOSETTING POLYETHYLENE RATED TYPE RW90, 1000 V.
.4 INNER JACKET: POLYVINYL CHLORIDE MATERIAL.
.5 ARMOUR: FLAT INTERLOCKING GALVANIZED STEEL.
.6 OVERALL COVERING: THERMOPLASTIC POLYVINYL CHLORIDE MATERIAL.
.7 FASTENINGS:
.1 ONE HOLE MALLEABLE IRON STRAPS TO SECURE SURFACE CABLES 2" (50 mm) AND SMALLER. TWO HOLE STEEL STRAPS FOR CABLES LARGER THAN 2" (50 mm).
.2 CHANNEL TYPE SUPPORTS FOR TWO OR MORE CABLES AT 15' (4.5 M) CENTERS.
.3 THREADED RODS: ¼" (6 mm) DIA. TO SUPPORT SUSPENDED CHANNELS.
.8 CONNECTORS:
.1 WATERTIGHT APPROVED FOR TECK CABLE.

2.3 ARMOURED CABLES
.1 CONDUCTORS: INSULATED, COPPER, SIZE AS INDICATED.
.2 TYPE: AC90.
.3 ARMOUR: INTERLOCKING TYPE FABRICATED FROM GALVANIZED STEEL STRIP.
.4 TYPE: ACWU90 - PVC JACKET OVER THERMOPLASTIC ARMOUR MEETING REQUIREMENTS OF VERTICAL TRAY FIRE TEST OF CSA C22.2 NO.0.3 WITH MAXIMUM FLAME TRAVEL OF 4' (1200 mm).

2.4 CONTROL CABLES
.1 TYPE LVT: 2 SOFT ANNEALED COPPER CONDUCTORS, SIZED AS INDICATED, WITH THERMOPLASTIC INSULATION, OUTER COVERING OF THERMOPLASTIC JACKET, AND ARMOUR OF CLOSELY WOUND ALUMINIUM WIRE FT-6 RATED.
.2 LOW ENERGY 300 V CONTROL CABLE: STRANDED ANNEALED COPPER CONDUCTORS SIZED AS INDICATED, WITH PVC INSULATION TYPE WITH SHIELDING OF WIRE BRAID OVER EACH CONDUCTOR PAIR OVER ALL CONDUCTORS AND OVERALL COVERING OF PVC JACKETS.
.3 600 V TYPE: STRANDED ANNEALED COPPER CONDUCTORS, SIZES AS INDICATED WITH PVC INSULATION TYPE RW90 (X-LINK) ETHYLENE-PROPYLENE RUBBER INSULATION TYPE WITH SHIELDING OF WIRE BRAID ALL CONDUCTORS AND OVERALL COVERING OF THERMOPLASTIC JACKET.

3.1 INSTALLATION OF BUILDING WIRES
.1 IN CONDUIT SYSTEMS IN ACCORDANCE WITH SECTION 16133.

3.2 INSTALLATION OF TECK CABLE 0 - 1000 V
.1 INSTALL CABLES.
.2 GROUP CABLES WHEREVER POSSIBLE ON CHANNELS.

3.3 INSTALLATION OF ARMOURED CABLES
.1 GROUP CABLES WHEREVER POSSIBLE.

3.4 INSTALLATION OF CONTROL CABLES
.1 INSTALL CONTROL CABLES IN CONDUIT.
.2 GROUND CONTROL CABLE SHIELD.

16131 - SPLITTERS, JUNCTION, PULL BOXES AND CABINETS

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

2.1 SPLITTERS
.1 SHEET METAL ENCLOSURE, WELDED CORNERS AND FORMED HINGED COVER SUITABLE FOR LOCKING IN CLOSED POSITION.
.2 MAIN AND BRANCH LUGS TO MATCH REQUIRED SIZE AND NUMBER OF INCOMING AND OUTGOING CONDUCTORS AS INDICATED.
.3 AT LEAST THREE SPARE TERMINALS ON EACH SET OF LUGS IN SPLITTERS LESS THAN 400 A.

2.2 JUNCTION AND PULL BOXES
.1 WELDED STEEL CONSTRUCTION WITH SCREW-ON FLAT COVERS FOR SURFACE MOUNTING.
.2 COVERS WITH 1" (25 mm) MINIMUM EXTENSION ALL AROUND, FOR FLUSH-MOUNTED PULL AND JUNCTION BOXES.

2.3 CABINETS
.1 TYPE E: SHEET STEEL, HINGED DOOR AND RETURN FLANGE OVERLAPPING SIDES, HANDLE, LOCK AND CATCH, FOR SURFACE MOUNTING.
.2 TYPE T: SHEET STEEL CABINET, WITH HINGED DOOR, LATCH, LOCK, 2 KEYS, CONTAINING ¾" (19 mm) SHEET STEEL BACKBOARD FOR SURFACE MOUNTING.

3.1 SPLITTER INSTALLATION
.1 INSTALL SPLITTERS AND MOUNT PLUMB, TRUE AND SQUARE TO THE BUILDING LINES.
.2 EXTEND SPLITTERS FULL LENGTH OF EQUIPMENT ARRANGEMENT EXCEPT WHERE INDICATED OTHERWISE.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION
.1 INSTALL PULL BOXES IN INCONSPICUOUS BUT ACCESSIBLE LOCATIONS.
.2 MOUNT CABINETS WITH TOP NOT HIGHER THAN 6'-6" (2 M) 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 100' (30 M) OF CONDUIT RUN BETWEEN PULL BOXES.

3.3 IDENTIFICATION
.1 PROVIDE EQUIPMENT IDENTIFICATION IN ACCORDANCE WITH SECTION 16010 - ELECTRICAL GENERAL REQUIREMENTS.
.2 INSTALL SIZE 2 IDENTIFICATION LABELS INDICATING SYSTEM NAME VOLTAGE AND PHASE.

16132 - OUTLET BOXES, CONDUIT BOXES AND FITTINGS

2.1 OUTLET AND CONDUIT BOXES GENERAL
.1 SIZE BOXES IN ACCORDANCE WITH CSA C22.1.
.2 4" (102 mm) 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 BARRIERS WHERE OUTLETS FOR MORE THAN ONE SYSTEM ARE GROUPED.

2.2 SHEET STEEL OUTLET BOXES
.1 ELECTRO-GALVANIZED STEEL SINGLE AND MULTI GANG FLUSH DEVICE BOXES FOR FLUSH INSTALLATION, MINIMUM SIZE 3" X 2" X 1-1/2" (76 X 50 X 38 mm) OR AS INDICATED. 4" (102 mm) 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 4" X 2-1/8" X 1-7/8" (102 X 54 X 48 mm).
.3 4" (102 mm) SQUARE OR OCTAGONAL OUTLET BOXES FOR LIGHTING FIXTURE OUTLETS.
.4 4" (102 mm) SQUARE OUTLET BOXES WITH EXTENSION AND PLASTER RINGS FOR FLUSH MOUNTING DEVICES IN FINISHED PLASTER TILE WALLS.

2.3 MASONRY BOXES
.1 ELECTRO-GALVANIZED STEEL MASONRY SINGLE AND MULTI GANG BOXES FOR DEVICES FLUSH MOUNTED IN EXPOSED BLOCK WALLS.

2.4 CONCRETE BOXES
.1 ELECTRO-GALVANIZED SHEET STEEL CONCRETE TYPE BOXES FOR FLUSH MOUNT IN CONCRETE WITH MATCHING EXTENSION AND PLASTER RINGS AS REQUIRED.

2.5 CONDUIT BOXES
.1 CAST FS OR FD ALUMINIUM BOXES WITH FACTORY-THREADED HUBS AND MOUNTING FEET FOR SURFACE WIRING OF SWITCHES AND RECEPTACLES

2.6 FITTINGS - GENERAL
.1 BUSHING AND CONNECTORS WITH NYLON INSULATED THROATS.
.2 KNOCK-OUT FILLERS TO PREVENT ENTRY OF DEBRIS.
.3 CONDUIT OUTLET BODIES FOR CONDUIT UP TO 1- 1/4"(32 mm) AND PULL BOXES FOR LARGER CONDUITS.
.4 DOUBLE LOCKNUTS AND INSULATED BUSHINGS ON SHEET METAL BOXES.

3.1 INSTALLATION
.1 SUPPORT BOXES INDEPENDENTLY OF CONNECTING CONDUITS.
.2 FILL BOXES WITH PAPER, SPONGES OR FOAM OR SIMILAR APPROVED MATERIAL TO PREVENT ENTRY OF DEBRIS DURING CONSTRUCTION. REMOVE UPON COMPLETION OF WORK.
.3 FOR FLUSH INSTALLATIONS MOUNT OUTLETS FLUSH WITH FINISHED WALL USING PLASTER RINGS TO PERMIT WALL FINISH TO COME WITHIN ¼" (6 mm) OF OPENING.
.4 PROVIDE CORRECT SIZE OF OPENINGS IN BOXES FOR CONDUIT, MINERAL INSULATED AND ARMOURED CABLE CONNECTIONS. REDUCING WASHERS ARE NOT ALLOWED.

16133 - CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

2.1 CONDUITS
.1 RIGID METAL CONDUIT: TO CSA C22.2 NO. 45, GALVANIZED STEEL THREADED.
.2 ELECTRICAL METALLIC TUBING (EMT): TO CSA C22.2 NO.83, WITH COUPLINGS WITH EXPANDED ENDS.
.3 RIGID PVC CONDUIT: TO CSA C22.2 NO.211.2.
.4 FLEXIBLE METAL CONDUIT: TO CSA C22.2 NO.56, STEEL ALUMINIUM LIQUID-TIGHT FLEXIBLE METAL.

2.2 CONDUIT FASTENINGS
.1 ONE HOLE MALLEABLE IRON STRAPS TO SURFACE CONDUITS NPS 2 (50 mm) AND SMALLER. TWO HOLE STEEL STRAPS FOR CONDUITS LARGER THAN NPS 2 (50 mm).
.2 BEAM CLAMPS TO SECURE CONDUITS TO EXPOSED STEEL WORK.
.3 CHANNEL TYPE SUPPORTS FOR TWO OR MORE CONDUITS AT 16' (5 M) OC.
.4 THREADED RODS, ¼" (6 mm) DIA., TO SUPPORT SUSPENDED CHANNELS.

2.3 CONDUIT FITTINGS
.1 FITTINGS: MANUFACTURED FOR USE WITH CONDUIT SPECIFIED. COATING: SAME AS CONDUIT.
.2 FACTORY "ELLS" WHERE 90° BENDS ARE REQUIRED FOR NPS 1 (25 mm) AND LARGER CONDUITS.
.3 WATERTIGHT CONNECTORS AND COUPLINGS FOR EMT. SET-SCREWS ARE NOT ACCEPTABLE.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT
.1 WEATHERPROOF EXPANSION FITTINGS WITH INTERNAL BONDING ASSEMBLY SUITABLE FOR 4" (100 mm) LINEAR EXPANSION.
.2 WATERTIGHT EXPANSION FITTINGS WITH INTEGRAL BONDING JUMPER SUITABLE FOR LINEAR EXPANSION AND ¾" (19 mm) DEFLECTION IN ALL DIRECTIONS.
.3 WEATHERPROOF EXPANSION FITTINGS FOR LINEAR EXPANSION AT ENTRY TO PANEL.

2.5 FISH CORD
.1 POLYPROPYLENE.

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 IN UNFINISHED AREAS.
.3 SURFACE MOUNT CONDUITS.
.4 USE RIGID GALVANIZED STEEL THREADED CONDUIT EXCEPT WHERE SPECIFIED OTHERWISE.
.5 USE ELECTRICAL METALLIC TUBING (EMT) EXCEPT IN CAST CONCRETE ABOVE 7'-10" (2.4 M) NOT SUBJECT TO MECHANICAL INJURY.
.6 USE RIGID PVC CONDUIT UNDERGROUND OR IN CORROSIVE AREAS.
.7 USE FLEXIBLE METAL CONDUIT FOR CONNECTION TO MOTORS IN DRY AREAS, CONNECTION TO RECESSED INCANDESCENT FIXTURES WITHOUT A PREWIRED OUTLET BOX, CONNECTION TO SURFACE OR RECESSED FLUORESCENT FIXTURES, WORK IN MOVABLE METAL PARTITIONS.
.8 USE LIQUID TIGHT FLEXIBLE METAL CONDUIT FOR CONNECTION TO MOTORS OR VIBRATING EQUIPMENT IN DAMP, WET OR CORROSIVE LOCATIONS.
.9 MINIMUM CONDUIT SIZE FOR LIGHTING AND POWER CIRCUITS: NPS 3/4 (19 mm).
.10 BEND CONDUIT COLD. REPLACE CONDUIT IF KINKED OR FLATTENED MORE THAN 1/10TH OF ITS ORIGINAL DIAMETER.
.11 MECHANICALLY BEND STEEL CONDUIT OVER NPS ¾" (19 mm).
.12 FIELD THREADS ON RIGID CONDUIT MUST BE OF SUFFICIENT LENGTH TO DRAW CONDUITS UP TIGHT.
.13 INSTALL FISH CORD IN EMPTY CONDUITS.
.14 REMOVE AND REPLACE BLOCKED CONDUIT SECTIONS. DO NOT USE LIQUIDS TO CLEAN OUT CONDUITS.
.15 DRY CONDUITS OUT BEFORE INSTALLING WIRE.
.16 PROVIDE SPARE CONDUITS C/W FISH CORDS AS INDICATED.

3.2 SURFACE CONDUITS
.1 RUN PARALLEL OR PERPENDICULAR TO BUILDING LINES.
.2 LOCATE CONDUITS BEHIND INFRARED OR GAS FIRED HEATERS WITH 5' (1.5 M) CLEARANCE.
.3 RUN CONDUITS IN FLANGED PORTION OF STRUCTURAL STEEL.
.4 GROUP CONDUITS WHEREVER POSSIBLE ON CHANNELS.
.5 DO NOT PASS CONDUITS THROUGH STRUCTURAL MEMBERS EXCEPT AS INDICATED.
.6 DO NOT LOCATE CONDUITS LESS THAN 3" (75 mm) PARALLEL TO STEAM OR HOT WATER LINES WITH MINIMUM OF 1" (25 mm) AT CROSSOVERS.
.7 INSTALL ONLY WITH ARCHITECT'S PERMISSION.

3.3 CONCEALED CONDUITS
.1 RUN PARALLEL OR PERPENDICULAR TO BUILDING LINES.
.2 DO NOT INSTALL HORIZONTAL RUNS IN MASONRY WALLS.
.3 DO NOT INSTALL CONDUITS IN TERRAZZO OR CONCRETE TOPPINGS.

3.4 CONDUITS UNDERGROUND
.1 SLOPE CONDUITS TO PROVIDE DRAINAGE.
.2 WATERPROOF JOINTS (PVC EXCEPTED) WITH HEAVY COAT OF BITUMINOUS PAINT.

DRAWING LIST

E0.01 KEY & FIRE PLAN - NOTES, LEGENDS & SCHEDULES
E1.01 EXISTING SCHOOL - NEW WORK
E1.02 GROUND & SECOND FLOOR AREA OF WORK #1 & #2 DEMOLITION & NEW WORK - LIGHTING & LIFE SAFETY POWER & COMMUNICATIONS
E3.01 DETAILS
E3.02 ELECTRICAL SPECIFICATIONS - 1 OF 2
E3.03 ELECTRICAL SPECIFICATIONS - 2 OF 2

No.	YYYY/MM/DD	DESCRIPTION
3	2026/08/25	ISSUED FOR CONSTRUCTION
2	2026/07/02	ISSUED FOR TENDER
1	2026/06/30	ISSUED FOR PERMIT
0	2026/05/12	ISSUED
A	2026/04/21	ISSUED FOR COORDINATION

REVISIONS

LICENSED PROFESSIONAL ENGINEER K. SEGUIN May 12/26 PROVINCE OF ONTARIO

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ELECTRICAL

ELECTRICAL SPECIFICATIONS - 1 OF 2

SCALE	DRAWN	PROJECT No.
AS NOTED	G.J.L	26-006
DATE	CHECKED	DRAWING No.
2026/04/07	K.S.	E3.02