

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 MATTER NOT SPECIFICALLY 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 OTHER TRADE DRAWINGS AND SPECIFICATIONS TO FULLY CO-ORDINATE THE INSTALLATION OF THE WORK.			
4. FURNISH ALL REQUIRED LABOUR AND MATERIALS, MACHINERY, SCHEMATIC, 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 WORKMANSOME MANNER, PROFICIENTLY, 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., EIMAC, 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 OBTAIN 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 WORKSMANSHIP. 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 WALLS, CEILINGS, FLOORS, AND PARTITIONS. ALL PENETRATIONS AND 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 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 ANY DIMENSIONAL SYSTEM UTILIZED FOR DRAWINGS. MAKE SURE 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. CONVEYANCE AND WIRING WHEREVER POSSIBLE BY RUNNING IT IN PIPE SPACES, DUCT SHAFTS, CHASES, CEILING SPACES AND PURVED OUT SECTIONS OF WALLS AND COLUMNS. DO NOT RUN CONDUIT EXPOSED IN FINISHED AREAS WITHOUT OBTAINING PERMISSION FROM 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 1500 AND 15020.			
1.11 OPERATING AND MAINTENANCE INSTRUCTIONS			
1. SUPPLY CERTIFIED PERSONNEL TO INSTRUCT OWNERS OPERATING START UP OPERATION OF ELECTRICAL EQUIPMENT. SUPPLY MAINTENANCE SPECIALIST PERSONNEL TO INSTRUCT OPERATING START UP 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 START 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.			
6. 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 INSTALLATION 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 1/8" DIA. SHALL 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 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 HAZARD AND OTHER DAMAGE BY AN ORDERLY MANNER. ALL ELECTRICAL EQUIPMENT INCLUDING LIGHT FIXTURES SHALL BE PROTECTED FROM CONSTRUCTION DUST AND DIRT. PROTECT OUTLETS BOXES FROM DAMAGE AND FROM THE INTRUSION OF FOREIGN MATTER.			
1.4 FIRE-STOPPING			
1. WHERE CONDUITS PASS THROUGH FIRE RATED WALLS, FLOORS AND PARTITIONS, PACK SPACE WITH MATERIAL OF MECHANICAL APPROVAL.			
2. DIVISION 16 TO PROVIDE ALL MATERIALS AND LABOUR TO COMPLETE U.L.C. FIRE-STOPPING FOR DIVISION 16 WORK.			
2.1 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 WITH OTHER TRADES AT REGULAR INTERVALS 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.			
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.			
5. METHODS OF CONSTRUCTION OF THE 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 CO-ORDINATED 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 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.			
6. FULLY INSTRUCT AND TRAIN OPERATING AND MAINTENANCE PERSONNEL IN CARE, ADJUSTMENT AND OPERATION OF ELECTRICAL SYSTEMS.			
7. TESTS DURING AND AT CONCLUSION OF PROJECT.			
8. SUBMIT TEST RESULTS FOR ENGINEER'S REVIEW.			
1.19 LOAD BALANCING			
1. MEASURE PHASE CURRENTS TO PANEL BOARDS WITH NORMAL LOADS (LIGHTING) OPERATING AT TIME OF ACCEPTANCE. ADJUST BRANCH CIRCUIT CONNECTIONS AS REQUIRED TO OBTAIN BEST BALANCE OF CURRENTS BETWEEN PHASES AND RECORD CHANGES.			
2. MEASURE PHASE VOLTAGES AT LOADS AND ADJUST TRANSFORMER TAPS TO WITHIN 2% OF RATED VOLTAGE OF EQUIPMENT.			
3. CONDUCT AT CONSTRUCTION CLOSE-OUT, 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.			
4. USE HIGH STRENGTH METAL ANCHORS NOT PERMITTED.			
5. ACCEPTABLE MATERIALS: H-11 TYPE HSL.			
6. DRILLED OR POWER DRIVEN ANCHORS NOT PERMITTED.			
7. SUSPENDED EQUIPMENT, SYSTEMS:			
1. ANCHOR EQUIPMENT TO EQUIPMENT SUPPORTS.			
2. ANCHOR EQUIPMENT TO EQUIPMENT SUPPORTS TO STRUCTURE.			
3. USE SIZE OF BOLTS SCHEDULED IN APPROVED SHOP DRAWINGS.			
4. SUSPENDED EQUIPMENT, SYSTEMS:			
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 SYSTEMS WHEREVER APPLICABLE.			
5. SYSTEMS: FIRE ALARM SYSTEM, EMERGENCY/EXIT LIGHTING SYSTEM, P.A. SYSTEM.			
6. FURNISH MANUFACTURER'S CERTIFICATE OR LETTER CONFIRMING THAT ENTIRE INSTALLATION AS SHOWN ON SHOP DRAWINGS HAS BEEN INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.			
7. INSULATION RESISTANCE TESTING.			
1. MEGGER CIRCUITS, FEEDERS AND EQUIPMENT UP TO 380 V WITH A 500 V INSTRUMENT.			
2. MEGGER 380-600 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.			
1.20 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. CONDUIT AND 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 SYSTEMS WHEREVER APPLICABLE.			
5. SYSTEMS: FIRE ALARM SYSTEM, EMERGENCY/EXIT LIGHTING SYSTEM, P.A. SYSTEM.			
6. FURNISH MANUFACTURER'S CERTIFICATE OR LETTER CONFIRMING THAT ENTIRE INSTALLATION AS SHOWN ON SHOP DRAWINGS HAS BEEN INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.			
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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. DO COMPLETE CIRCUIT TESTS ON OVERCURRENT TRIPS, RELAYS AND FUSES ARE INSTALLED TO REQUIRED VALUES AND SETTINGS.			
1.23 COMMISSIONING AND STARTUP			
1. EQUIPMENT AND 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 SUPERVISOR DURING START-UP OF INSTALLATION.			
3. COORDINATE WITH DIVISION 15 REQUIREMENTS AND FORCES.			
1.24 SLACK CABLE RESTRAINT SYSTEM (SCS)			
1. SCS TO PREVENT SWAY IN HORIZONTAL PLANE, "ROCKING" IN VERTICAL PLANE, SLIDING AND BUCKLING IN ALL DIRECTIONS.			
2. HANGER RODS TO WITHSTAND COMPRESSIVE LOADING AND BUCKLING.			
3. STAYS TO PREVENT SWAY IN HORIZONTAL PLANE, "ROCKING" IN VERTICAL PLANE, SLIDING AND BUCKLING IN ALL DIRECTIONS.			
4. HANGER RODS TO WITHSTAND COMPRESSIVE LOADING AND BUCKLING.			
1.25 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 BRACKETS 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 10' MAX SPACING.			
4. MAINTAIN MINIMUM SPACING OF SCS AT 20' MAXIMUM OR AS LIMITED BY ANCHOR-SLACK CABLE PERFORMANCE.			
5. ORIENT RESTRAINT WIRES ON CEILING HUNG EQUIPMENT AT APPROXIMATELY 90 DEG. TO EACH OTHER IN PLANE OF THE RESTRAINTS.			
6. ADJUST RESTRAINT CABLES SO THAT THEY ARE NOT VISIBLY SLACK BUT PERMIT VIBRATION.			
7. ISOLATION SYSTEM TO FUNCTION NORMALLY.			
8. UNDERGROUND CABLES TO BE INSTALLED IN A MANNER THAT THEY DO NOT PROTRUDE FROM THE SURFACE OF THE CONCRETE.			
9. SUPPORT WEIGHT DURING NORMAL OPERATION.			
3. INSTALL SRS AT LEAST 25 mm FROM ALL OTHER EQUIPMENT, SYSTEMS, SERVICES.			
4. MISCELLANEOUS EQUIPMENT NOT VIBRATION SENSITIVE.			
5. BOLT THROUGH HUNG EQUIPMENT TO STRUCTURE.			
6. CO-ORDINATE CONNECTIONS WITH ALL DISCIPLINES.			
1.26 INSPECTION AND CERTIFICATION			
1. EQUIPMENT AND SYSTEMS TO BE CERTIFIED BY THE SEISMIC ENGINEER UPON COMPLETION OF INSTALLATION.			
2. PROVIDE WRITTEN REPORT TO THE CONSULTANT WITH CERTIFICATE OF COMPLIANCE.			
3. COMPLETION DOCUMENTATION			
1. UPON COMPLETION AND ACCEPTANCE OF CERTIFICATION, HAND OVER TO THE CONSULTANT COMPLETE SET OF CONSTRUCTION DOCUMENTS, REVISED TO SHOW "AS-BUILT" CONDITIONS.			
1.27 FASTENING AND SUPPORTS			
1. SUPPORT CHANNELS			
1. U-SHAPED: SIZE 4" X 4" 1/4", 2.5 mm THICK SURFACE MOUNTED SUSPENDED SET IN POURED CONCRETE WALLS AND CEILINGS.			
1.28 INSTALLATION			
1. SECURE EQUIPMENT TO SOLID MASONRY, TILE AND PLASTER SURFACES WITH LEAD ANCHORS OR NYLON SHIELDS.			
2. EQUIPMENT TO BE MOUNTED TO POURED CONCRETE WITH EXPANDABLE INSERTS.			
3. SECURE EQUIPMENT TO MOUNTED MASONRY WALLS OR SUSPENDED CEILINGS WITH TOGGLE BOLTS.			
4. SECURE SURFACE-MOUNTED EQUIPMENT WITH TWIST CLIP FASTENERS TO INVERTED T-BAR CEILING. ENSURE THAT T-BARS ARE ADEQUATELY SUPPORTED TO CARRY WEIGHT OF EQUIPMENT SPECIFIED BEFORE INSTALLATION.			
5. SECURE EQUIPMENT, CONDUIT OR CABLES USING CLIPS, SPRING-LOADED BOLTS, CABLE CLAMPS DESIGNED AS ACCESSORIES TO EQUIPMENT MEMBERS.			
6. FASTEN EXPOSED CONDUIT OR CABLES TO BUILDING CONSTRUCTION OR SUPPORT SYSTEM USING STRAPS.			
7. ONE-HOLE MALLEABLE IRON STRAPS TO SECURE SURFACE CONDUITS AND CABLES 50 mm AND SMALLER.			
8. TWO-HOLE STEEL STRAPS FOR CONDUITS AND CABLES LARGER THAN 50 mm.			
9. BEAM CLAMPS TO SECURE CONDUIT TO EXPOSED STEEL WORK.			
10. 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 8 mm DIA THREADED ROD HANGERS WHERE DIRECT FASTENING TO BUILDING CONSTRUCTION IS NOT POSSIBLE.			
3. FOR SURFACE MOUNTING OF TWO OR MORE CONDUITS USE CHANNELS.			
4. PROVIDE METAL BRACKETS, FRAMES, HANGERS, CLAMPS AND RELATED TYPES OF SUPPORT.			
5. PROVIDE METAL BRACKETS, FRAMES, HANGERS, CLAMPS AND RELATED TYPES OF SUPPORT.			
6. ENSURE ADEQUATE SUPPORT FOR RACEWAYS AND CABLES DRAPPED VERTICALLY TO EQUIPMENT WHERE THERE IS NO WALL SUPPORT.			
7. DO NOT USE WIRE LASHING OR PERFORATED STRAP TO SUPPORT OR SECURE RACEWAYS OR CABLES.			
8. 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.			
9. EQUIPMENT VIA CABLE TRAY AND POWER CONDUIT SYSTEMS OF EQUIPMENT CABLES AND CONDUITS, AND IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION.			
10. ALL LIGHT FIXTURES INSTALLED IN OR ON T-BAR CEILINGS TO BE INDEPENDENTLY SUPPORTED. USE APPROPRIATE JACK CHAIN AND ANCHORS.			
1.29 SURFACE RACEWAY SYSTEM (WIRING LAID IN)			
1.1 PROTECTION			
1. SUBMIT PRODUCT DATA IN ACCORDANCE WITH SECTIONS 16010.			
2. INDICATE TYPES OF RACEWAYS WITH TERMINOLOGY SIMILAR TO THAT USED IN THIS SECTION.			
1.2 SURFACE RACEWAY SYSTEM (WIRING LAID IN)			
1. TWO-PIECE, STEEL ASSEMBLY, CW CENTRE BARRIER.			
2. CONDITIONS VARY AND APPROVAL OF ENGINEER AND LOCAL AUTHORITY HAVING JURISDICTION OVER INSTALLATION.			
3. REQUIRED FOR COMPLETE INSTALLATION.			
4. REFERRED SUPPLIER: WIREMOLD CAT. NO. V4000 SERIES.			
1.3 CHANNING RACEWAY			
1. TYPE: METAL RACEWAY: STEEL, SOLID.			
1.4 FITTINGS			
1. WELDS, TEES, COUPLINGS AND HANGER FITTINGS: MANUFACTURED AS ACCESSORIES TO RACEWAY SYSTEM.			
2. REQUIRED FOR COMPLETE INSTALLATION.			
3. CORNERS, PULL BOXES, ELBOWS, TEES, TWO-PIECE ASSEMBLY TO FACILITATE SITE WIRING.			
4. CROSS-SECTION DIMENSIONS AS INDICATED.			
5. ACCEPTABLE MANUFACTURERS:			
1. WIREMOLD (NEPCO)			
1.5 INSTALLATION			
1. INSTALL RACEWAYS BEFORE INSTALLATION OF WIRING. INSTALL COVERINGS FOR RACEWAYS AND SUPERFICIALLY FINISH.			
2. INSTALL SUPPORTING BRACKETS, ELBOWS, TEES, CONNECTORS, FITTINGS, BUSHINGS, ADAPTORS AND REQUIRED.			
3. KEEP NUMBER OF ELBOWS, OFFSETS, CONNECTIONS TO MINIMUM.			
4. USE RIGID PVC CONDUIT UNDERGROUND OR IN CORROSIVE AREAS.			
5. INSTALL BRACKETS IN RACEWAYS WHERE DIFFERENT VOLTAGE SYSTEMS ARE INDICATED.			
1.6 REFERENCES			
1. CSA C22.2 NO. 0.342: TEST METHODS FOR ELECTRICAL WIRES AND CABLES.			
2. CAN/CSA C22.2 NO. 131: TYPE TCK 90 DRILLING.			
1.7 PRODUCT DATA			
1. SUBMIT PRODUCT DATA AND SHOP DRAWINGS FOR ENGINEER REVIEW IN ACCORDANCE WITH GENERAL REQUIREMENTS.			
2. BUILDING WIRING			
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. CONDUCTORS: SIZE AS INDICATED, WITH THERMOPLASTIC INSULATION TYPE TWH RATED AT 600 V.			
1.8 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. INSULATIONS:			
1. TYPE: ETHYLENE PROPYLENE RUBBER.			
2. CHEMICALLY CROSS-LINKED THERMOSETTING POLYETHYLENE RATED TYPE RW90, 1000 V.			
3. DETAILS OF FASTENERS AND ATTACHMENTS TO STRUCTURE, ANCHORAGE LOADINGS.			
4. ATT			