DRAWING SPECIFICATIONS - ELECTRICAL (DIVISION 16)

SECTION 16001 - SCOPE OF WORK

1. PROVIDE ALL LABOR, MATERIAL, EQUIPMENT AND SERVICES FOR THE PROPER INSTALLATION AND OPERATION OF THE ELECTRICAL WORK AS INDICATED ON THE DRAWINGS.
2. REMOVE OR RELOCATE EXISTING ELECTRICAL EQUIPMENT AS REQUIRED BY THE PROJECT.
3. TEST AND OPERATE ALL SYSTEMS TO DEMONSTRATE TO THE OWNER THAT THE INSTALLATION OF THESE SYSTEMS CONFORM TO DESIGN INTENT.

SECTION 16050- BASIC ELECTRICAL REQUIREMENTS

1. COMPLY WITH ALL RULES AND REGULATIONS OF THE OWNER, ALL LOCAL, STATE AND FEDERAL LAWS, THE RULES OF THE NATIONAL FIRE PROTECTION ASSOCIATION (INCLUDING THE NEC), THE OWNER'S UNDERWRITER, AND ALL PUBLIC UTILITIES HAVING CONNECTION WITH ANY OF THE AFFECTED SYSTEMS. ALL EQUIPMENT SHALL BE UL LABELED.
2. OBTAIN, PAY FOR AND DELIVER ALL PERMITS, CERTIFICATES OF INSPECTION, AND PAY ALL COSTS, REQUIRED BY THE AUTHORITIES HAVING JURISDICTION. DELIVER ALL PERMITS, CERTIFICATES AND APPROVALS TO THE ENGINEER PRIOR TO FINAL ACCEPTANCE OF THE WORK.
3. APPLY FOR SERVICE FROM THE ELECTRIC UTILITY COMPANY AND SCHEDULE THEIR WORK IN COORDINATION WITH THE PROJECT.
4. FURNISH INDEPENDENT INSPECTION AGENCY CERTIFICATES FOR ALL ELECTRICAL WORK. ALL CERTIFICATES SHALL BE IN DUPLICATE AND SHALL BE DELIVERED TO THE ENGINEER AND SHALL BECOME THE PROPERTY OF THE OWNER.
5. VERIFY ALL EXISTING CONDITIONS IN THE FIELD BEFORE SUBMITTING A BID. NO ALLOWANCE WILL BE MADE FOR EXTRA COSTS ARISING FROM FAILURE TO DO SO.
6. IT IS THE INTENTION OF THE DRAWINGS AND SPECIFICATIONS TO CALL FOR CLEAR FINISHED WORK, TESTED AND READY FOR OPERATION. PROVIDE ALL INCIDENTAL ACCESSORIES NECESSARY TO MAKE THE WORK COMPLETE IN ALL RESPECTS AND READY FOR OPERATION, EVEN IF NOT PARTICULARLY SPECIFIED OR SHOWN, WITHOUT ADDITIONAL EXPENSE. MINOR DETAILS NOT USUALLY SHOWN OR SPECIFIED, BUT MANIFESTLY NECESSARY FOR THE PROPER INSTALLATION AND OPERATION OF THE VARIOUS SYSTEMS, SHALL BE INCLUDED IN THE WORK.
7. SUBMIT 7 COPIES OF SHOP DRAWINGS. SHOP DRAWINGS SHALL INCLUDE PLANS, ELEVATIONS, SECTIONS, MOUNTING DETAILS OF COMPONENT PARTS, POINT TO POINT INTERCONNECTION DIAGRAMS, ELEMENTARY DIAGRAMS, SINGLE LINE DIAGRAMS AND ANY OTHER DRAWINGS NECESSARY TO SHOW THE FABRICATION AND CONNECTION OF THE COMPLETE ITEM OR SYSTEM.
8. KEEP RECORD DRAWINGS IN THE JOB SITE OFFICE. MAINTAIN RECORD DRAWINGS DAILY AND MAKE THEM AVAILABLE FOR INSPECTION BY THE OWNER OR ENGINEER UPON DEMAND. AT THE COMPLETION OF THE PROJECT, BIND THE PRINTS INTO A SET AND FORWARD THEM TO THE ENGINEER. THE RECORD DRAWINGS SHALL CONSIST OF A SEPARATE SET OF WHITE PRINTS OF THE CONTRACT DRAWINGS ON WHICH SHALL BE RECORDED IN INK OR COLORED PENCIL THE FOLLOWING:
   A. DIMENSIONED LOCATIONS OF CONDUITS BURIED BELOW, OR CAST INTO, CONCRETE FLOOR SLABS.
   B. LIGHTING FIXTURE ARRANGEMENTS, IF DIFFERENT FROM CONTRACT DRAWINGS.
   C. LOCATIONS OF ELECTRIC PANELS, MOTOR STARTERS, AND OTHER WALL MOUNTED EQUIPMENT, IF DIFFERENT FROM CONTRACT DRAWINGS.
   D. ALL WORK ADDED TO THE CONTRACT BY FIELD SKETCHES, ADDENDUM OR CHANGE ORDER.
9. BEFORE COMPLETION OF THE INSTALLATION, FURNISH THREE COPIES OF MANUALS COVERING IN DETAIL ALL REQUIRED INSTRUCTIONS FOR THE OPERATION OF THE SYSTEMS PROVIDED.
10. FURNISH ALL LABOR REQUIRED BY THE ENGINEER, OR INSPECTION AGENCIES TO EXAMINE THE WORK DURING THE COURSE OF CONSTRUCTION.
11. FURNISH A WRITTEN WARRANTY FOR THE INSTALLATION, STATING THAT ALL MATERIALS AND EQUIPMENT AND THE SYSTEMS WHICH THEY COMPRISE ARE FREE FROM DEFECTS OR FLAWS IN WORKMANSHIP OR OPERATION, AND ARE FUNCTIONING PROPERLY AND CAPABLE OF PROVIDING SATISFACTORY OPERATION IN ACCORDANCE WITH DESIGN INTENT. REPAIR OR REPLACE ANY DEFECTIVE WORKMANSHIP, DEFECTIVE MATERIALS OR EQUIPMENT, OR CORRECT UNSATISFACTORY PERFORMANCE, WITHOUT EXPENSE TO THE OWNER. MAKE REPAIRS OR REPLACEMENTS PROMPTLY AND AT THE CONVENIENCE OF THE OWNER. THE WARRANTY SHALL BE IN EFFECT FOR A PERIOD OF ONE YEAR FROM DATE OF ACCEPTANCE OF THE SYSTEMS AS A WHOLE.
12. MATERIAL OR EQUIPMENT SPECIFIED BY MANUFACTURER, BRAND NAME, TYPE OR CATALOG NUMBER, ARE DESIGNED TO ESTABLISH STANDARDS OF DESIRED QUALITY, PERFORMANCE, DIMENSIONS AND OTHER CHARACTERISTICS. SUBSTITUTIONS WILL NOT BE PERMITTED WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER. WHERE ANY SUBSTITUTION REQUIRES REDESIGN OR RELOCATION OF THE STRUCTURES, PIPING, RACEWAYS, WIRING OR ANY OTHER PART OF THE ELECTRICAL, MECHANICAL, OR ARCHITECTURAL WORK, ALL REDESIGN SHALL BE PREPARED BY THE CONTRACTOR AT HIS OWN EXPENSE AND SUBMITTED FOR THE APPROVAL OF THE ENGINEER. ALL ADDITIONAL WORK MADE NECESSARY BY THE SUPSTITUTION SHALL BE PROVIDED WITHOUT EXTRA COST.
13. UPON REQUEST, PROVIDE COPIES OF MATERIAL SAFETY DATA SHEETS (MSDS) FOR ANY MATERIALS USED IN THE WORK AND NOT SUPPLIED BY THE OWNER. MSDS SHEETS SHALL BE PROVIDED BEFORE DELIVERY OF MATERIALS TO THE JOB SITE.
14. ALL WORK SHALL BE PERFORMED BY WORKMEN SKILLED IN THE TRADE. ALL WORKMANSHIP SHALL PRESENT A NEAT AND FINISHED APPEARANCE. COMPLY WITH NECA RULES WHEREVER POSSIBLE.
15. PROTECT THE BUILDING, ITS CONTENTS AND ALL NEW WORK AGAINST DAMAGE FROM ANY SOURCE UNTIL FINAL COMPLETION AND ACCEPTANCE BY THE OWNER. REPAIR OR REPLACE ANY DAMAGED WORK AT NO COST TO THE OWNER.
16. AT ALL TIMES, KEEP THE PREMISES FREE FROM ACCUMULATION OF WASTE MATERIAL AND RUBBISH.
17. PROVIDE ALL RIGGING, SCAFFOLDING, LADDERS, AND OTHER EQUIPMENT REQUIRED FOR THE INSTALLATION OF THE WORK.
18. ESTABLISH CLEARANCES REQUIRED TO DELIVER AND INSTALL ALL EQUIPMENT. IF STRUCTURES OR EQUIPMENT MUST BE ALTERED TO PROVIDE PASSAGE, RESTORE STRUCTURES, EQUIPMENT AND SYSTEMS TO THEIR ORIGINAL CONDITION.
19. MAKE A COMPLETE INSPECTION OF ALL THE ELECTRICAL WORK AFTER COMPLETION OF THE PROJECT. PERFORM TESTS IN COMPLIANCE WITH EACH EQUIPMENT MANUFACTURER'S TEST PROCEDURES AND THE ACCEPTANCE TEST STANDARDS OF THE INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA). PROVIDE ALL INSTRUMENTS, METERS, WIRING, PERSONNEL, ETC., REQUIRED FOR TESTING.
20. AFTER ALL ADJUSTMENTS AND TESTS HAVE BEEN COMPLETED, CLEAN ALL PARTS OF THE INSTALLATION, INCLUDING INTERIORS OF BOXES, CABINETS AND EQUIPMENT ENCLOSURES. CLEAN LIGHTING FIXTURE LENSES AND REFLECTORS WITH ANTI-STATIC DETERGENT TO ENSURE RATED OUTPUT.

SECTION 16110 - CONDUIT SYSTEMS

1. INSTALL ALL WIRE AND CABLES IN ELECTRICAL METALLIC TUBING UNLESS OTHERWISE SPECIFIED OR INDICATED BY THE DRAWINGS. ELECTRICAL METALLIC TUBING (EMT) SHALL BE GALVANIZED STEEL IN ACCORDANCE WITH FS WWC 563, ANSI C80.3 AND UL 797. FITTINGS 1-1/4-INCH AND SMALLER SHALL BE COMPRESSION TYPE AND 1-1/2-INCH AND LARGER SHALL BE SET SCREW TYPE. ALL FITTINGS SHALL BE OF WROUGHT STEEL CONSTRUCTION.
2. RIGID ALUMINUM CONDUIT WITH THREADED FITTINGS SHALL BE USED FOR ALL CONDUIT INSTALLATIONS EXPOSED TO THE WEATHER. RIGID ALUMINUM CONDUIT SHALL BE 6063 ALLOY, T41 TEMPER, CONFORMING TO FS WWC 540, ANSI C80.5 AND UL 6. FITTINGS SHALL BE THREADED TYPE OF ALUMINUM CONSTRUCTION.
3. LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT SHALL BE USED FOR CONNECTION TO MOTORS AND OTHER EQUIPMENT WHICH PRODUCES OR TRANSMITS VIBRATION OR NOISE, UNLESS THE MOTORS OR EQUIPMENT ARE MOUNTED ABOVE SUSPENDED CEILING. PROVIDE SUITABLE BONDING JUMPER FOR ALL CONNECTIONS. LIQUID-TIGHT FLEXIBLE METAL CONDUIT SHALL BE CONSTRUCTED OF SINGLE STRIP, FLEXIBLE, CONTINUOUS, INTERLOCKED AND DOUBLE-WRAPPED STEEL, GALVANIZED INSIDE AND OUTSIDE AND COATED WITH LIQUID-TIGHT JACKET OF FLEXIBLE POLYVINYL CHLORIDE (PVC). FITTINGS SHALL BE LIQUID-TIGHT COMPRESSION TYPE.
4. FLEXIBLE METALLIC CONDUIT (MIN. 1/2-INCH TRADE SIZE) SHALL BE USED FOR CONNECTION FROM A JUNCTION BOX TO LIGHTING FIXTURES, MOTORS AND SIMILAR EQUIPMENT MOUNTED IN A SUSPENDED CEILING, AS WELL AS FOR CONNECTION TO TRANSFORMERS. FLEXIBLE METAL CONDUIT SHALL BE FORMED FROM CONTINUOUS LENGTH OF SPIRALLY WOUND, INTERLOCKED ZINC-COATED STRIP STEEL CONFORMING TO FS WWC 566 AND UL 1. FITTINGS SHALL BE OF THE THREADLESS, HINGED CLAMP TYPE.
5. RIGID STEEL CONDUIT SHALL BE USED WHERE CONDUIT IS ENCASED IN THE BUILDING'S POURED CONCRETE CONSTRUCTION. RIGID STEEL CONDUIT SHALL BE HOT DIP GALVANIZED CONFORMING TO FS WWC 581, ANSI C80.1 AND UL 6.
6. FITTINGS SHALL BE THREADED TYPE OF GALVANIZED MALLEABLE IRON CONSTRUCTION.
7. HEAVY WALL PVC CONDUIT SHALL BE USED FOR ALL GROUNDING CONDUCTORS AND OTHER SPECIFIC USES AS INDICATED BY THE DRAWINGS. HEAVY WALL PVC CONDUIT SHALL BE SCHEDULE 40, 90 DEGREES C, UL RATED, CONSTRUCTED OF POLYVINYL CHLORIDE AND CONFORMING TO NEMA TC-2 FOR DIRECT BURIAL OR NORMAL ABOVE GROUND USE. FITTING SHALL BE OF THE SOLVENT WELD TYPE. CONDUITS SHALL BE SUPPORTED WITH NON-METALLIC DEVICES.
8. MINIMUM SIZE CONDUIT UNLESS OTHERWISE INDICATED SHALL BE 3/4-INCH TRADE SIZE. ALL CONDUITS WHICH ARE TO REMAIN EMPTY SHALL BE PROVIDED WITH A NYLON PULL LINE. CONDUITS SHALL BE INDEPENDENTLY SUPPORTED FROM THE BUILDING STRUCTURE AND SHALL NOT BE ATTACHED TO THE SUPPORT SYSTEMS PROVIDED BY OTHER TRADES UNLESS SPECIFICALLY INDICATED.
9. PROVIDE SLEEVES FOR ALL CONDUITS PASSING THROUGH FLOOR SLABS AND WALLS. THE ANNULAR SPACE BETWEEN THE WALL AND THE SLEEVE SHALL BE KEPT TO A MINIMUM AND FILLED WITH FIRE STOP MATERIALS. SLEEVES SHALL BE NOMINALLY 1-INCH TRADE SIZE LARGER AND CONSTRUCTED OF THE SAME MATERIAL AS THE CONDUIT BEING INSTALLED.

SECTION 16120 - WIRE AND CABLES (600 VOLT AND BELOW)

1. WIRE AND CABLES FOR FEEDER AND BRANCH CIRCUITS SHALL BE SINGLE ANNEALED STRANDED COPPER CONDUCTORS WITH CONDUCTIVITY OF NOT LESS THAN 98 PERCENT AT 20 DEGREES C. WIRE AND CABLE SHALL BEAR THE UL LABEL AND SHALL MEET OR EXCEED THE REQUIREMENTS OF IPCEA-NEMA STANDARDS S-19-81 AND ASTM D-1352.
2. WIRE SIZES SHALL GENERALLY BE AS FOLLOWS:
   A. CONTROL AND INTERLOCK WIRING NO. 14 AWG.
   B. BRANCH CIRCUIT AND FEEDER WIRING NO. 12 AWG AND LARGER.
3. WIRE AND CABLE INSULATION SHALL BE AS FOLLOWS:
   A. CONDUCTORS SIZE NO. 14 AWG THROUGH NO. 4/0 AWG SHALL BE 600 VOLT TYPE THWN FOR DRY AND WET LOCATIONS WITH A MAXIMUM OPERATING TEMPERATURE OF 75 DEGREES C.
   B. CONDUCTORS SIZE 250 KCMIL AND LARGER SHALL BE 600 VOLT TYPE THHN/THWN OR XHHW FOR DRY AND WET LOCATIONS WITH A MAXIMUM OPERATING TEMPERATURE OF 90 AND 75 DEGREES C., RESPECTIVELY.
4. FOR CONVENIENCE IN TESTING AND MAINTENANCE ALL SECONDARY CONDUCTORS SHALL BE COLOR-CODED IN ACCORDANCE WITH THE ESTABLISHED BUILDING STANDARD. CONTROL CIRCUIT WIRING SHALL HAVE SEPARATED IDENTIFYING COLORS OR NUMBERS.
5. METAL-CLAD CABLE (TYPE MC) SHALL BE PERMISSIBLE FOR INSTALLATION OF INDOOR BRANCH CIRCUITS NOT MORE THAN 30 AMPERES ABOVE ACCESSIBLE CEILING AND IN HOLLOW DRYWALL PARTITIONS, WITHOUT BEING INSTALLED IN RACEWAYS, IF PERMISSIBLE BY CODE. TYPE MC CABLES SHALL NOT BE INSTALLED EXPOSED, INCLUDING IN ELECTRICAL CLOSETS. TYPE MC CABLE SHALL BE SUPPORTED AND SECURED NOT EXCEEDING EVERY 6-FEET, AND SHALL BE SECURED WITHIN 12-INCHES OF EVERY BOX, CABINET, OR FITTING FOR CABLES. TYPE MC CABLE SHALL NOT BE USED IN HEALTH CARE FACILITIES. METAL-CLAD CABLE (TYPE MC) SHALL BE COPPER, MULTI CONDUCTOR TYPE, WITH NO MORE THAN EIGHT CONDUCTORS. THE INTERLOCKING SHEATH SHALL BE OF EITHER GALVANIZED STEEL OR ALUMINUM. CONDUCTORS SHALL BE SOFT-ANNEALED COPPER, MEETING ASTM B3, AND STRANDED AS PER ASTM B8. TYPE MC CABLE SHALL BE UL LABELED. THE GROUNDING CONDUCTOR SHALL BE INSULATED AND SHALL BE ROUTED WITH THE CIRCUIT CONDUCTORS.
6. TYPE NM NON-METALLIC SHEATHED CABLE IF PERMITTED BY AHJ SHALL BE PERMISSIBLE FOR INSTALLATION OF INDOOR BRANCH CIRCUITS WHERE CONCEALED. TYPE NM CABLES SHALL NOT BE INSTALLED EXPOSED, INCLUDING IN ELECTRICAL CLOSETS. TYPE NM CABLE SHALL BE SUPPORTED AND SECURED NOT EXCEEDING EVERY 4-1/2-FEET, AND SHALL BE SECURED WITHIN 12-INCHES OF EVERY BOX, CABINET, OR FITTING FOR CABLES. TYPE NM CABLES SHALL BE COPPER, MULTI-CONDUCTOR TYPE WITH GROUND, WITH NO MORE THAN FOUR CONDUCTORS. CONDUCTORS SHALL BE SOFT-ANNEALED COPPER, MEETING NEMA WC 70. TYPE NM CABLE SHALL BE UL LABELED. THE GROUNDING CONDUCTOR SHALL BE ROUTED WITH THE CIRCUIT CONDUCTORS. WHERE INSULTAED, THE INSULATION SHALL BE GREEN IN COLOR.
7. PROVIDE UL LABELED CONNECTORS OF AMPACITY RATINGS AND TYPES FOR APPLICATIONS INDICATED.
   A. CONNECTIONS FOR WIRE SIZES NO. 14 AWG THROUGH NO. 10 AWG SHALL BE MADE WITH 3-M "SCOTCHLOK" SPRING CONNECTORS.
   B. CONDUCTORS NO. 8 AWG AND LARGER SHALL BE SPLICED AND TAPPED WITH COLOR-KEYED WROUGHT COPPER COMPRESSION CONNECTORS AS MANUFACTURED BY THOMAS & BETTS. THE MANUFACTURER'S RECOMMENDED TOOLING SHALL BE USED FOR INSTALLATION. LONG BARREL SLEEVES, TWO HOLE LUGS AND "C" TYPE CONNECTORS SHALL BE USED. SPLICE AND TAP CONNECTORS SHALL BE COMPATIBLE WITH CONDUCTOR MATERIAL.
8. UNLESS SPECIFICALLY INDICATED OTHERWISE, EACH SINGLE PHASE BRANCH CIRCUIT SHALL CONSIST OF RESPECTIVE PHASE CONDUCTOR AND A DEDICATED NEUTRAL CONDUCTOR.
9. PROVIDE A SEPARATE INSULATED GROUND WIRE IN EACH FEEDER, BRANCH CIRCUIT AND OTHER CONDUITS CONTAINING CURRENT CARRYING CONDUCTORS. EQUIPMENT GROUNDING CONDUCTORS SHALL BE GREEN-COLORED OR IDENTIFIED WITH GREEN TAPE AT ALL ACCESS POINTS.

SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

1. OUTLET BOXES SHALL BE CONSTRUCTED OF GALVANIZED FLAT ROLLED SHEET-STEEL OF SHAPES AND SIZES SUITABLE FOR INSTALLATION OF WIRING DEVICES. PROVIDE BOXES WITH THREADED SCREW HOLES, WITH CORROSION-RESISTANT COVER AND GROUNDING SCREWS FOR FASTENING SURFACE AND DEVICE TYPE BOX COVERS AND FOR EQUIPMENT TYPE GROUNDING. OUTLET BOX ACCESSORIES SHALL BE PROVIDED AS REQUIRED FOR EACH INSTALLATION.
2. JUNCTION AND PULL BOXES SHALL BE CONSTRUCTED OF GALVANIZED CODE-GAUGE SHEET STEEL WITH SCREW-ON COVERS OF TYPES, SHAPES AND SIZES TO SUIT EACH RESPECTIVE LOCATION AND INSTALLATION. BOXES SHALL BE OF RIVETED OR WELDED CONSTRUCTION AND SHALL HAVE PLAIN MACHINE SCREW ATTACHED COVERS.
3. ALL OUTDOOR BOXES AND WIREWAYS SHALL BE CONSTRUCTED OF PLASTIC.
4. CEILING BOXES FOR SUSPENDED LIGHT FIXTURES OR CEILING FANS SHALL BE CONSTRUCTED OF PHENOLIC WITH STEEL BAR HANGERS, LISTED TO SUPPORT 50 LBS (MINIMUM) AND FOR USE IN TWO HOUR FIRE-RATED CEILINGS.
5. BOXES FOR OUTDOOR OUTLETS SHALL BE WEATHER PROOF PLASTIC WITH IN-USE COVERS AS MANUFACTURED BY TAY-MAC OR EQUAL.

SECTION 16140 - WIRING DEVICES

1. GENERAL PURPOSE DUPLEX RECEPTACLES SHALL BE RESIDENTIAL GRADE, TAMPER-RESISTANT, 2-POLE, 3-WIRE, GROUNDING TYPE, RATED 15 AMPERES, 125-VOLTS, NEMA CONFIGURATION 5-15R, HUBBELL RR15STR OR APPROVED EQUAL.
2. INDOOR GROUND FAULT DUPLEX RECEPTACLES SHALL BE RESIDENTIAL GRADE, TAMPER-RESISTANT, 2-POLE, 3-WIRE GROUNDING TYPE, RATED 15 AMPERES, 125 VOLTS, NEMA CONFIGURATION 5-15R, HUBBELL GFTR15, OR APPROVED EQUAL.
3. OUTDOOR GROUND FAULT DUPLEX RECEPTACLES SHALL BE RESIDENTIAL GRADE, WEATHER-RESISTANT AND TAMPER-RESISTANT, 2-POLE, 3-WIRE GROUNDING TYPE, RATED 15 AMPERES, 125 VOLTS, NEMA CONFIGURATION 5-15R, HUBBELL GFR5262SG, OR APPROVED EQUAL.
4. DRYER OUTLETS SHALL BE RATED 30 AMPERES, 125/250 VOLTS, NEMA CONFIGURATION 14-30R (3-WIRE GROUNDING), WITH FLUSH WALL PLATE, HUBBELL RR430 OR EQUAL.
5. SINGLE-POLE TOGGLE SWITCHES SHALL BE SPECIFICATION GRADE, QUIET TYPE RATED 15 AMPERES, 120 VOLTS, 60 HERTZ, HUBBELL RS115, OR APPROVED EQUAL.
6. THREE-WAY TOGGLE SWITCHES SHALL BE SPECIFICATION GRADE, QUIET TYPE RATED 15 AMPERES, 120 VOLTS, 60 HERTZ, HUBBELL RS315, OR APPROVED EQUAL.
7. FOUR-WAY TOGGLE SWITCHES SHALL BE SPECIFICATION GRADE, QUIET TYPE RATED 15 AMPERES, 120 VOLTS, 60 HERTZ, HUBBELL RS415, OR APPROVED EQUAL.
8. WALLPLATES SHALL BE FOR SINGLE WIRING DEVICES OF TYPES, SIZES AND WITH GANGING AND CUTOUTS AS REQUIRED. WALLPLATES SHALL BE STANDARD SIZE, NYLON.
9. PROVIDE AN INSULATED EQUIPMENT GROUNDING CONDUCTOR CONNECTION FOR ALL WIRING DEVICES, UNLESS OTHERWISE INDICATED.
10. PRIOR TO ENERGIZING CIRCUITRY, TEST WIRING FOR ELECTRICAL CONTINUITY AND FOR SHORT-CIRCUITS. ENSURE PROPER POLARITY OF CONNECTIONS IS MAINTAINED.
11. SMALL OFFICE OCCUPANCY SENSORS SHALL BE WATTSTOPER MODEL DW-100 DUAL TECHNOLOGY WALL SWITCH TYPE FOR MOUNTING IN A SINGLE-GANG WALL BOX. SET SENSORS FOR MANUAL ON, AUTO OFF OPERATION.

SECTION 16145 - LIGHTING CONTROL DEVICES

1. SWITCH-BOX OCCUPANCY SENSORS SHALL BE PIR TYPE WITH INTEGRAL POWER-SWITCHING CONTACTS RATED FOR 800 W AT 120-V AC, SUITABLE FOR INCANDESCENT LIGHT FIXTURES, FLUORESCENT LIGHT FIXTURES WITH MAGNETIC OR ELECTRONIC BALLASTS, OR 1/6-HP MOTORS; AND RATED FOR 1000 W AT 277-V AC, SUITABLE FOR INCANDESCENT LIGHT FIXTURES, FLUORESCENT LIGHT FIXTURES WITH MAGNETIC OR ELECTRONIC BALLASTS, OR 1/3-HP MOTORS, MINIMUM.
   A. AUTOMATIC LIGHT-LEVEL SENSOR: ADJUSTABLE FROM 2 TO 200 FC; KEEPS LIGHTING OFF WHEN SELECTED LIGHTING LEVEL IS PRESENT.
   B. FIELD SELECTABLE TO CONVERT SENSOR OPERATION FROM AUTOMATIC ON TO MANUAL ON.
2. INDOOR OCCUPANCY SENSORS SHALL BE WALL OR CEILING-MOUNTED, SOLID-STATE UNITS WITH A SEPARATE RELAY UNIT.
   A. OPERATION: UNLESS OTHERWISE INDICATED, TURN LIGHTS ON WHEN COVERED AREA IS OCCUPIED AND OFF WHEN UNOCCUPIED; WITH A TIME DELAY FOR TURNING LIGHTS OFF, ADJUSTABLE OVER A MINIMUM RANGE OF 1 TO 30 MINUTES. SET AT 15 MINUTES.
   B. SENSOR OUTPUT: CONTACTS RATED TO OPERATE THE CONNECTED RELAY, COMPLYING WITH UL 773A. SENSOR SHALL BE POWERED FROM THE RELAY UNIT.
   C. RELAY UNIT: DRY CONTACTS RATED FOR 20A BALLAST LOAD AT 120 AND 277V AC, FOR 13A TUNGSTEN AT 120V AC, AND FOR 1 HP AT 120V AC. POWER SUPPLY TO SENSOR SHALL BE 24V DC, 150-MA, CLASS 2 POWER SOURCE AS DEFINED BY NFPA 70.
   D. MOUNTING:
      a) SENSOR: SUITABLE FOR MOUNTING IN ANY POSITION ON A STANDARD OUTLET BOX.
      b) TIME-DELAY AND SENSITIVITY ADJUSTMENTS: RECESSED AND CONCEALED BEHIND HINGED DOOR.
   E. INDICATOR: LED, TO SHOW WHEN MOTION IS BEING DETECTED DURING TESTING AND NORMAL OPERATION OF THE SENSOR.
   F. BYPASS SWITCH: MANUAL OVERRIDE IN CASE OF SENSOR FAILURE.
   G. AUTOMATIC LIGHT-LEVEL SENSOR: ADJUSTABLE FROM 2 TO 200 FC; KEEPS LIGHTING OFF WHEN SELECTED LIGHTING LEVEL IS PRESENT.
3. INDOOR OCCUPANCY SENSOR SHALL BE ONE OF THE FOLLOWING TYPES AS INDICATED ON THE DRAWINGS:
   A. PIR TYPE: CEILING MOUNTING; DETECT OCCUPANCY BY SENSING A COMBINATION OF HEAT AND MOVEMENT IN AREA OF COVERAGE.
      a) DETECTOR SENSITIVITY: DETECT OCCURRENCES OF 6-INCH MINIMUM MOVEMENT OF ANY PORTION OF A HUMAN BODY THAT PRESENTS A TARGET OF AT LEAST 36 SQ. IN.
      b) DETECTION COVERAGE (ROOM): DETECT OCCUPANCY ANYWHERE IN A CIRCULAR AREA OF 1000 SQ. FT. WHEN MOUNTED ON A 96-INCH HIGH CEILING.
      c) DETECTION COVERAGE (CORRIDOR): DETECT OCCUPANCY WITHIN 90-FEET WHEN MOUNTED ON A 10-FOOT HIGH CEILING.
   B. ULTRASONIC TYPE: CEILING MOUNTING; DETECT OCCUPANCY BY SENSING A CHANGE IN PATTERN OF REFLECTED ULTRASONIC ENERGY IN AREA OF COVERAGE.
      a) DETECTOR SENSITIVITY: DETECT A PERSON OF AVERAGE SIZE AND WEIGHT MOVING AT LEAST 12-INCHES IN EITHER A HORIZONTAL OR A VERTICAL MANNER AT AN APPROXIMATE SPEED OF 12-INCHES PER SECOND.
      b) DETECTION COVERAGE (SMALL ROOM): DETECT OCCUPANCY ANYWHERE WITHIN A CIRCULAR AREA OF 600 SQ. FT. WHEN MOUNTED ON A 96-INCH HIGH CEILING.
      c) DETECTION COVERAGE (STANDARD ROOM): DETECT OCCUPANCY ANYWHERE WITHIN A CIRCULAR AREA OF 1000 SQ. FT. WHEN MOUNTED ON AN 8-FOOT HIGH CEILING.
      d) DETECTION COVERAGE (LARGE ROOM): DETECT OCCUPANCY ANYWHERE WITHIN A CIRCULAR AREA OF 2000 SQ. FT. WHEN MOUNTED ON A 96-INCH HIGH CEILING.
      e) DETECTION COVERAGE (CORRIDOR): DETECT OCCUPANCY ANYWHERE WITHIN 90-FEET WHEN MOUNTED ON A 10-FOOT HIGH CEILING IN A CORRIDOR NOT WIDER THAN 14-FEET.
   C. DUAL-TECHNOLOGY TYPE: CEILING MOUNTING; DETECT OCCUPANCY BY USING A COMBINATION OF PIR AND ULTRASONIC DETECTION METHODS IN AREA OF COVERAGE. PARTICULAR TECHNOLOGY OR COMBINATION OF TECHNOLOGIES THAT CONTROLS ON AND OFF FUNCTIONS SHALL BE SELECTABLE IN THE FIELD BY OPERATING CONTROLS ON UNIT.
      a) SENSITIVITY ADJUSTMENT: SEPARATE FOR EACH SENSING TECHNOLOGY.
      b) DETECTOR SENSITIVITY: DETECT OCCURRENCES OF 6-INCH MINIMUM MOVEMENT OF ANY PORTION OF A HUMAN BODY THAT PRESENTS A TARGET OF AT LEAST 36 SQ. IN., AND DETECT A PERSON OF AVERAGE SIZE AND WEIGHT MOVING AT LEAST 12-INCHES IN EITHER A HORIZONTAL OR A VERTICAL MANNER AT AN APPROXIMATE SPEED OF 12-INCHES PER SECOND.
      c) DETECTION COVERAGE (STANDARD ROOM): DETECT OCCUPANCY ANYWHERE WITHIN A CIRCULAR AREA OF 1000 SQ. FT. WHEN MOUNTED ON A 96-INCH HIGH CEILING.
4. MULTI-POLE CONTACTORS SHALL BE ELECTRICALLY OPERATED AND ELECTRICALLY HELD, COMPLYING WITH NEMA ICS 2 AND UL 508.
   A. CURRENT RATING FOR SWITCHING: LISTING OR RATING CONSISTENT WITH TYPE OF LOAD SERVED, INCLUDING TUNGSTEN FILAMENT, INDUCTIVE, AND HIGH-INRUSH BALLAST (BALLAST WITH 15 PERCENT OR LESS TOTAL HARMONIC DISTORTION OF NORMAL LOAD CURRENT).
   B. CONTROL-COIL VOLTAGE: MATCH CONTROL POWER SOURCE.
5. CONDUCTORS AND CABLES FOR LIGHTING CONTROL SYSTEM SHALL BE:
   A. POWER WIRING TO SUPPLY SIDE OF REMOTE-CONTROL POWER SOURCES: NOT SMALLER THAN NO. 12 AWG, COMPLYING WITH DIVISION 16 SECTION 16120.
   B. CLASSES 2 AND 3 CONTROL CABLE: MULTICONDUCTOR CABLE WITH STRANDED COPPER CONDUCTORS NOT SMALLER THAN NO. 22 AWG.
   C. CLASS 1 CONTROL CABLE: MULTICONDUCTOR CABLE WITH STRANDED COPPER CONDUCTORS NOT SMALLER THAN NO. 16 AWG.
6. INSTALL AND AIM SENSORS IN LOCATIONS TO ACHIEVE AT LEAST 90 PERCENT COVERAGE OF AREAS INDICATED. DO NOT EXCEED COVERAGE LIMITS SPECIFIED IN MANUFACTURER'S WRITTEN INSTRUCTIONS.
7. PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS:
   A. AFTER INSTALLING TIME SWITCHES AND SENSORS, AND AFTER ELECTRICAL CIRCUITRY HAS BEEN ENERGIZED, ADJUST AND TEST FOR COMPLIANCE WITH REQUIREMENTS.
   B. OPERATIONAL TEST: VERIFY ACTUATION OF EACH SENSOR AND ADJUST TIME DELAYS.
8. REMOVE AND REPLACE LIGHTING CONTROL DEVICES WHERE TEST RESULTS INDICATE THAT THEY DO NOT COMPLY WITH SPECIFIED REQUIREMENTS.
9. OCCUPANCY ADJUSTMENTS: WHEN REQUESTED WITHIN 12 MONTHS OF DATE OF SUBSTANTIAL COMPLETION, PROVIDE ON-SITE ASSISTANCE IN ADJUSTING SENSORS TO SUIT ACTUAL OCCUPIED CONDITIONS. PROVIDE UP TO TWO VISITS TO SITE OUTSIDE NORMAL OCCUPANCY HOURS FOR THIS PURPOSE.
10. OUTDOOR PHOTOELECTRIC SWITCHES SHALL BE SOLID STATE, WITH SPST DRY CONTACTS RATED FOR [1800-VA TUNGSTEN OR 1000-VA INDUCTIVE], TO OPERATE CONNECTED RELAY, CONTACTOR COILS, MICROPROCESSOR INPUT, AND COMPLYING WITH UL 773A.
   A. LIGHT-LEVEL MONITORING RANGE: 1.5 TO 10 FC, WITH AN ADJUSTMENT FOR TURN-ON AND TURN-OFF LEVELS WITHIN THAT RANGE [, AND A DIRECTIONAL LENS IN FRONT OF PHOTOCELL TO PREVENT FIXED LIGHT SOURCES FROM CAUSING TURN-OFF].
   B. TIME DELAY: 15-SECOND MINIMUM, TO PREVENT FALSE OPERATION.
   C. SURGE PROTECTION: METAL-OXIDE VARISTOR TYPE, COMPLYING WITH IEEE C62.41 FOR CATEGORY A1 LOCATIONS.
   D. MOUNTING: TWIST LOCK COMPLYING WITH IEEE C136.10, WITH BASE-AND-STEM MOUNTING OR STEM-AND-SWIVEL MOUNTING ACCESSORIES AS REQUIRED TO DIRECT SENSOR TO THE NORTH SKY EXPOSURE.
11. DIGITAL TIME SWITCHES SHALL BE ELECTRONIC, SOLID-STATE PROGRAMMABLE UNITS WITH ALPHANUMERIC DISPLAY COMPLYING WITH UL 917.
   A. CONTACT CONFIGURATION: DPST.
   B. CONTACT RATING: 30-A INDUCTIVE OR RESISTIVE, 240-V AC
   C. PROGRAMS: 2 CHANNELS.
      a) FOR EACH CHANNEL, 8 ON-OFF SET POINTS ON A 24-HOUR SCHEDULE.
      b) CIRCUITRY: ALLOW CONNECTION OF A PHOTOELECTRIC RELAY AS SUBSTITUTE FOR ON AND OFF FUNCTION OF A PROGRAM.
   D. ASTRONOMICAL TIME: ALL CHANNELS.
   E. BATTERY BACKUP: FOR SCHEDULES AND TIME CLOCK.
   F. REMOTE OVERRIDE: OVERRIDE SHUTOFF FUNCTION FOR ADJUSTABLE DURATION FOR EACH CHANNEL UP TO FOUR HOURS VIA LOW VOLTAGE WIRING.

SECTION 16170 - DISCONNECT SWITCHES

1. PROVIDE SURFACE-MOUNTED, HEAVY-DUTY TYPE, SHEET-STEEL ENCLOSED SAFETY SWITCHES, OF TYPES, SIZES AND ELECTRICAL CHARACTERISTICS INDICATED. SWITCHES SHALL BE QUICK-MAKE, QUICK-BREAK TYPE CONSTRUCTED SO THAT SWITCH BLADES ARE VISIBLE IN OFF POSITION WITH DOOR OPEN. EQUIP WITH OPERATING HANDLE WHICH IS INTEGRAL PART OF ENCLOSURE BASE AND WHOSE OPERATING POSITION IS EASILY RECOGNIZABLE, AND IS PADLOCKABLE IN THE ON OR OFF POSITION. CONSTRUCT CURRENT CARRYING PARTS OF HIGH-CONDUCTIVITY COPPER, WITH SILVER-TUNGSTEN TYPE SWITCH CONTACTS AND POSITIVE PRESSURE TYPE REINFORCED FUSE CLIPS. SWITCH ENCLOSURES GENERALLY SHALL BE NEMA TYPE I AND 3R FOR RAIN-TIGHT CONSTRUCTION.
2. PROVIDE FUSES FOR SAFETY SWITCHES, AS RECOMMENDED BY SWITCH MANUFACTURER, OF CLASSES, TYPES AND RATINGS NEEDED TO FULFILL ELECTRICAL REQUIREMENTS FOR SERVICE INDICATED.
3. FOR EACH SAFETY SWITCH ON THE LOAD SIDE OF A VARIABLE FREQUENCY DRIVE, PROVIDE A SINGLE POLE, DOUBLE THROW AUXILIARY CONTACT TO STOP THE VARIABLE FREQUENCY DRIVE WHEN THE SAFETY SWITCH IS IN THE OFF POSITION. INTERLOCK WIRING BETWEEN DISCONNECT SWITCH AND VARIABLE FREQUENCY DRIVE SHALL BE IN SEPARATE RACEWAY FROM THE MOTOR FEEDER WIRING FROM THE DRIVE.
4. PROVIDE A 30A, 1 POLE DISCONNECT SWITCH AT EACH FIRE ALARM AND NAC BOOSTER PANEL. SWITCH SHALL BE PAINTED RED AND LABELED "FIRE ALARM CIRCUIT"

SECTION 16190 - SUPPORTING DEVICES

1. PROVIDE SUPPORTING DEVICES OF TYPES, SIZES AND MATERIALS INDICATED, HAVING THE FOLLOWING CONSTRUCTION FEATURES:
   A. CLEVIS HANGERS SHALL BE USED FOR SUPPORTING 2" AND LARGER CONDUIT AND SHALL BE CONSTRUCTED OF GALVANIZED STEEL WITH ½" DIAMETER HOLE FOR ROUND STEEL ROD.
   B. ONE-HOLE CONDUIT STRAPS SHALL BE USED FOR SUPPORTING 3/4" TO 1-1/2" CONDUIT AND SHALL BE CONSTRUCTED OF GALVANIZED STEEL.
   C. TWO-HOLE CONDUIT STRAPS SHALL BE USED FOR SUPPORTING CONDUIT ON STEEL RACKS.
2. PROVIDE STEEL ANCHORS OF TYPES, SIZES AND MATERIALS REQUIRED FOR THE EQUIPMENT BEING SUPPORTED.
3. PROVIDE CABLE SUPPORTS WITH INSULATING WEDGING PLUG FOR NON-ARMORED TYPE ELECTRICAL CABLES IN RISERS.
4. PROVIDE U-CHANNEL STRUT SYSTEM FOR SUPPORTING ELECTRICAL EQUIPMENT, 12-GAUGE HOT-DIP GALVANIZED STEEL, OF TYPES AND SIZES INDICATED AND WITH THE CONDUIT CLAMPS, CONDUIT HANGERS AND OTHER FITTINGS WHICH MATE AND MATCH WITH U-CHANNEL.
5. INSTALL HANGERS, SUPPORTS, CLAMPS AND ATTACHMENTS TO SUPPORT PIPING PROPERLY FROM BUILDING STRUCTURE. ARRANGE FOR GROUPING OF PARALLEL RUNS OF HORIZONTAL CONDUITS TO BE SUPPORTED TOGETHER ON TRAPEZE TYPE HANGERS WHERE POSSIBLE. INSTALL SUPPORTS WITH SPACINGS INDICATED AND IN COMPLIANCE WITH NEC REQUIREMENTS.
6. NO MINERALLAC "JIFFY" TYPE CONDUIT SUPPORTS SHALL BE INSTALLED EXPOSED BELOW 8'-0" A.F.F. USE ONE-HOLE STRAPS INSTEAD.

SECTION 16195 - ELECTRICAL IDENTIFICATION

1. PANELBOARDS MOTOR STARTERS AND SIMILAR ELECTRICAL ENCLOSURES SHALL BE IDENTIFIED BY NAMEPLATES SHOWING THE EQUIPMENT IDENTIFICATION NUMBER, VOLTAGE AND FEEDER OR BRANCH CIRCUIT NUMBERS (E.G. PANEL LP-1 - 208/120 VOLTS - FDR 1-5). NAMEPLATES GENERALLY SHALL BE CUSTOM TWO-TONE LAMINATED PLASTIC WITH BEVELED EDGES. NAMEPLATES, UNLESS OTHERWISE INDICATED, SHALL BE WHITE LETTERS ON BLACK BACKGROUND.
2. CONDUITS SHALL BE IDENTIFIED IN EACH ROOM AND 50 FOOT ON CENTERS IN OPEN AREAS BY VOLTAGE AND FEEDER NUMBER (E.G. FDR 1-5 - 208/120 VOLTS). CONDUIT MARKERS SHALL BE STANDARD PRE-PRINTED FLEXIBLE PLASTIC SHEET MATERIAL OR SELF-ADHERING VINYL LABELS.
3. FEEDER CONDUCTORS IN EACH PULL BOX AND IDENTIFIED WITH A PAPER TAG AS TO NUMBER, VOLTAGE AND CABLE SIZE (E.G. FDR 1-5 - 208/120 VOLTS - 4 NO. 250 MCM). BRANCH CIRCUITS SHALL BE IDENTIFIED WITH A PAPER TAG IN EACH JUNCTION AND OUTLET BOX BY PANEL AND CIRCUIT NUMBER (E.G. PNL. LP-5 - CIRC. 3).

SECTION 16470 - PANELBOARDS

1. PANELBOARDS SHALL BE NEMA 1 FOR SURFACE OR RECESSED MOUNTING, CIRCUIT BREAKER TYPE, IN A SINGLE WIDTH FACTORY ASSEMBLED ENCLOSURE INCLUDING BOX, INTERIOR, TRIM AND FRONT. PANELBOARDS AND ENCLOSING CABINETS SHALL CONFORM TO STANDARDS ESTABLISHED BY UNDERWRITERS' LABORATORIES, INC., AND REQUIREMENTS OF NEC AND SHALL BEAR THE UL LABEL. UNLESS OTHERWISE INDICATED, PANELBOARDS SHALL BE MOUNTED 6 FEET TO THE TOP OF THE CABINET.
2. EACH PANELBOARD SHALL BE PROVIDED WITH AN INSULATED NEUTRAL BUS AND A GROUND BUS BONDED TO THE PANEL BACKBOX. NEUTRAL AND GROUND BUS SHALL BE READILY IDENTIFIED AND SHALL BE PROVIDED WITH SCREW TYPE TERMINALS. ALL BUS BARS SHALL BE ELECTRICAL GRADE COPPER. THE MAIN BUS BRACING SHALL BE EQUAL OR GREATER THAN THE INTERRUPTING CURRENT RATING CALLED FOR BY THE DRAWINGS.
3. EACH PANEL SHALL BE EQUIPPED WITH A TYPEWRITTEN DIRECTORY, INDICATING PLAINLY WHAT EACH BRANCH CIRCUIT OF THE PANEL CONTROLS. THE DIRECTORY SHALL BE PLACED IN A CLEAR PLASTIC PROTECTIVE ENVELOPE AND FASTENED TO THE INSIDE OF THE DOOR.
4. BRANCH CIRCUIT PROTECTION DEVICES SHALL BE MOLDED CASE CIRCUIT BREAKERS WITH QUICK-MADE, QUICK-BREAK TOGGLE MECHANISM, INVERSE TIME DELAY OVERLOAD AND INSTANTANEOUS SHORT CIRCUIT PROTECTION BY MEANS OF THERMAL MAGNETIC ELEMENT. AUTOMATIC TRIPPING SHALL BE INDICATED BY A HANDLE POSITION BETWEEN THE MANUAL "OFF" AND "ON" POSITION. BREAKERS SHALL BE "BOLT-ON" INTERCHANGEABLE TYPE AND CAPABLE OF BEING OPERATED IN ANY POSITION. CIRCUIT BREAKERS SHALL BE DESIGNED TO CARRY THEIR FULL RATING CONTINUOUSLY IN AMBIENT TEMPERATURE OF 40 DEGREES C. TWO AND THREE POLE BREAKERS SHALL HAVE COMMON TRIP HANDLE. ALL LIGHTING BRANCH CIRCUIT BREAKERS SHALL BE SWITCH RATED. PANELBOARDS SHALL HAVE MAIN AND BRANCH CIRCUIT BREAKERS AS INDICATED ON THE DRAWINGS. WHERE PANELS HAVE SPACES FOR FUTURE BREAKERS, THE SPACE SHALL INCLUDE COMPLETE BUSWORK, HARDWARE, APPURTENANCES, ETC., TO ACCOMMODATE FUTURE BREAKERS.
5. PROVIDE LOCKING DEVICES FOR CIRCUIT BREAKERS WHICH ARE TO BE KEPT IN LOCKED POSITION. FOR ALL CIRCUIT BREAKERS SERVING RANGES (WHETHER CORD-AND-PLUG CONNECTED OR HARD WIRED) OR OTHER HARD WIRED APPLIANCES, PROVIDE PADLOCKING OR OTHER PROVISIONS TO LOCK THE CIRCUIT BREAKER IN THE "OFF" POSITION.

SECTION 16473 - TRANSIENT VOLTAGE SURGE SUPPRESSION

1. TRANSIENT VOLTAGE SURGE SUPPRESSOR (TVSS) SHALL BE LISTED IN ACCORDANCE WITH UL 1449, STANDARD FOR SAFETY, THIRD EDITION, TRANSIENT VOLTAGE SURGE SUPPRESSORS, AND UL 1283, ELECTROMAGNETIC INTERFERENCE FILTERS. TVSS SHALL BE TESTED WITH THE CATEGORY C3 HIGH EXPOSURE WAVEFORM (20KV-1.2/50MS, 10KA-8/20MS) PER ANSI/IEEE C62.41 - 1991.
2. TVSS SHALL BE MODULAR IN DESIGN. EACH SUPPRESSION ELEMENT SHALL BE A USER REPLACEABLE SURGE CURRENT DIVERSION MODULE. (MOV BASED) EACH SURGE CURRENT DIVERSION MODULE SHALL BE FUSED WITH USER REPLACEABLE 200 KAIC RATED FUSES. EACH SURGE CURRENT DIVERSION MODULE SHALL INCLUDE SOLID STATE STATUS INDICATOR LIGHTS AND THERMAL CUTOUTS.
3. TVSS SHALL PROVIDE REDUNDANT SURGE CURRENT DIVERSION MODULES BETWEEN EACH PHASE CONDUCTOR AND THE NEUTRAL CONDUCTOR AND BETWEEN THE NEUTRAL CONDUCTOR AND GROUND. FOR DELTA CONFIGURED SYSTEMS, THE TVSS SHALL HAVE COMPONENTS DIRECTLY CONNECTED BETWEEN EACH PHASE CONDUCTOR AND BETWEEN EACH PHASE CONDUCTOR AND GROUND. EACH MODE OF PROTECTION SHALL UTILIZE TWO CURRENT SHARING SURGE CURRENT DIVERSION MODULES IN PARALLEL FOR EITHER A WYE OR DELTA CONFIGURATION.
4. TVSS SHALL INCORPORATE COPPER BUS BARS FOR THE SURGE CURRENT PATH. SURGE CURRENT DIVERSION MODULES SHALL USE BOLTED CONNECTIONS TO THE BUS BARS FOR RELIABLE LOW IMPEDANCE CONNECTIONS.
5. TVSS SHALL MEET OR EXCEED THE FOLLOWING CRITERIA:
   A. MAXIMUM SINGLE IMPULSE CURRENT RATING SHALL BE 240KA, PER PHASE FOR SERVICE ENTRANCE EQUIPMENT AND 160KA PER PHASE FOR DISTRIBUTION PANELBOARD PROTECTION.
   B. PULSE LIFE TEST: CAPABLE OF PROTECTING AGAINST AND SURVIVING 5000 ANSI/IEEE C62.41 CATEGORY C3 TRANSIENTS WITHOUT FAILURE OR DEGRADATION OF UL 1449 VOLTAGE PROTECTION RATING BY MORE THAN 10%.
   C. UL 1449 SUPPRESSION VOLTAGE RATINGS SHALL NOT EXCEED THE FOLLOWING:

VOLTAGE	L-N	N-G	MCOV
208Y/120	330V	330V	150V

   D. THE ANSI/IEEE C62.41-1991 CATEGORY C3 LET THROUGH VOLTAGES SHALL NOT EXCEED THE FOLLOWING:

VOLTAGE	L-N	N-G	MCOV
208Y/120	470V	470V	150V

6. TVSS SHALL BE DESIGNED TO WITHSTAND A MAXIMUM CONTINUOUS OPERATING VOLTAGE (MCOV) OF NOT LESS THAN 115% OF NOMINAL RMS VOLTAGE.
7. TVSS SHALL HAVE A MINIMUM EMI/RFI FILTERING OF -50DB AT 100KHZ WITH AN INSERTION RATIO OF 50:1 USING MIL STD. 220A METHODOLOGY.
8. TVSS SHALL BE EQUIPPED WITH ONBOARD VISUAL AND AUDIBLE DIAGNOSTIC MONITORING. RED AND GREEN INDICATOR LIGHTS SHALL PROVIDE FULL TIME VISUAL DIAGNOSTIC MONITORING OF THE OPERATIONAL STATUS OF EACH PHASE, AS WELL AS EACH SURGE CURRENT DIVERSION MODULE. AUDIBLE DIAGNOSTIC MONITORING SHALL BE BY WAY OF AUDIBLE ALARM. THIS ALARM SHALL ACTIVATE UPON A FAULT CONDITION. AN ALARM ON/OFF SWITCH SHALL BE PROVIDED TO SILENCE THE ALARM. AN ALARM PUSH TO TEST SWITCH SHALL BE PROVIDED. THE TVSS DIAGNOSTIC MONITORING DEVICES SHALL BE MOUNTED ON THE FRONT OF THE ENCLOSURE. THE DIAGNOSTIC MONITORING CIRCUITS SHALL CONTINUALLY MONITOR THE OPERATIONAL STATUS OF THE SURGE CURRENT DIVERSION MODULES. NO OTHER TEST EQUIPMENT SHALL BE REQUIRED FOR TVSS MONITORING OR TESTING BEFORE OR AFTER INSTALLATION.
9. TVSS SHALL HAVE A RESPONSE TIME NO GREATER THAN 1 NANOSECOND FOR ANY OF THE INDIVIDUAL PROTECTION MODES.
10. TVSS WILL HAVE A WARRANTY FOR A PERIOD OF FIVE YEARS, INCORPORATING UNLIMITED REPLACEMENTS OF SUPPRESSOR PARTS DURING THE WARRANTY PERIOD.
11. TVSS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION. MINIMIZE LENGTH AND BENDS IN CABLE CONNECTION.

SECTION 16480 - MOTOR STARTERS

1. PROVIDE COMBINATION CIRCUIT BREAKER/MAGNETIC MOTOR STARTER FOR EQUIPMENT REQUIRING MANUAL AND AUTOMATIC CONTROL. STARTERS GENERALLY SHALL BE FULL VOLTAGE NON-REVERSING UNITS CONSISTING OF A [FUSED DISCONNECT] [NON-FUSIBLE DISCONNECT] [MOTOR CIRCUIT PROTECTOR], HORSEPOWER RATED CONTACTOR AND THERMAL OVERLOAD RELAY MOUNTED IN A NEMA TYPE I COMMON ENCLOSURE. STARTER UNITS SHALL BE FURNISHED WITH EXTERNAL OPERATING HANDLE, CONTROL CIRCUIT TRANSFORMER (120V. SECONDARY), PILOT LIGHT, THERMAL OVERLOADS AND, UNLESS OTHERWISE INDICATED, A HAND-OFF-AUTOMATIC SELECTOR SWITCH. AUXILIARY CONTACTS SHALL BE PROVIDED AS REQUIRED. COMBINATION STARTERS SHALL BE ALLEN BRADLEY BULLETIN [512] [513], OR APPROVED EQUAL SUITABLE FOR THE VOLTAGE AND HORSEPOWER INDICATED ON THE DRAWINGS. STARTER UNITS SHALL BE MINIMUM NEMA SIZE "0".
2. MANUAL MOTOR STARTERS SHALL BE PROVIDED FOR EQUIPMENT REQUIRING MANUAL CONTROL ONLY. MANUAL STARTING SWITCHES GENERALLY SHALL BE FULL VOLTAGE NON-REVERSING UNITS CONSISTING OF A MOTOR RATED TOGGLE SWITCH AND THERMAL OVERLOAD RELAY MOUNTED IN A COMMON ENCLOSURE. STARTER UNITS SHALL BE FURNISHED WITH A NEON PILOT LIGHT. UNITS IN MECHANICAL AREAS OR OTHERWISE UNFINISHED AREAS SHALL HAVE A NEMA TYPE I SURFACE MOUNTED ENCLOSURE. UNITS IN FINISHED AREAS SHALL BE MOUNTED IN A RECESSED BOX WITH FLUSH COVER PLATE. MANUAL MOTOR STARTERS SHALLBE ALLEN BRADLEY BULLETIN 600 OR APPROVED EQUAL SUITABLE FOR FRACTIONAL HORSEPOWER MOTORS AT 120 VOLTS, 60 HERTZ.
3. THE CONTRACTOR SHALL COORDINATE WITH OTHER TRADES TO DETERMINE THE QUANTITY AND SIZE OF MOTOR STARTERS REQUIRED IN ACCORDANCE WITH APPROVED SHOP DRAWINGS. MOTOR THERMAL OVERLOAD UNITS SHALL BE PROVIDED IN ACCORDANCE WITH THE ACTUAL MOTOR NAMEPLATE.

SECTION 16495 - AUTOMATIC TRANSFER SWITCH

1. PROVIDE AN AUTOMATIC TRANSFER SWITCH COMPLETE WITH ALL RELAYS, TIMERS AND ASSOCIATED CONTROL CIRCUITRY TO AUTOMATICALLY START THE ENGINE, TRANSFER THE LOAD TO STANDBY POWER UPON FAILURE OF THE NORMAL POWER SOURCE, TRANSFER THE LOAD BACK TO NORMAL POWER UPON ITS RESTORATION AND STOP THE ENGINE. TRANSFER SWITCH SHALL BE LISTED PER UNDERWRITER'S LABORATORIES UL-1008 FOR TOTAL SYSTEM LOAD AND SHALL INCLUDE NEMA I ENCLOSURE WITH TEST SWITCH AND INDICATION LIGHTS, AND [INPHASE MONITOR] [OR] [DELAYED TRANSITION] FOR MOTOR LOAD TRANSFER. AUTOMATIC TRANSFER SWITCHES SHALL BE ASCO 7000 SERIES, OR EQUAL BY RUSSELECTRIC OR GE ZENITH.

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SEAL:

ELECTRICAL SPECIFICATIONS

HOLIDAY INN EXPRESS & SUITES
INTERSECTION OF HAYNES PLACE & LAMM RD.
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