

- B. SERVICE AND DISTRIBUTION SECTIONS SHALL CONTAIN CIRCUIT BREAKERS, FUSIBLE SWITCHES, AND COMBINATION MOTOR STARTERS, WITH SHUNT TRIPS, MOTOR OPERATORS, GROUND FAULT PROTECTION, AND OTHER ACCESSORIES, AS INDICATED ON THE DRAWINGS, AS WELL AS PROVISIONS FOR UTILITY METERING SHALL BE IN ACCORDANCE WITH THE SERVING ELECTRIC UTILITY REQUIREMENTS. EACH DISCONNECTING MEANS SHALL BE PROVIDED WITH A MEANS FOR INDIVIDUAL PADLOCKING. SWITCHES SHALL BE HEAVY-DUTY, QUICK-MAKE AND QUICK-BREAK, AND HORSEPOWER RATED THROUGH 500 HP. SWITCHES RATED OVER 600 AMPERES SHALL BE BOLTED PRESSURE CONTACT TYPE. RATINGS OF DISCONNECTING MEANS AND OVERCURRENT PROTECTIVE DEVICES SHALL BE AS INDICATED ON THE DRAWINGS.
- C. FINISH: INTERIOR FINISH SHALL BE A GRAY LACQUER OR ENAMEL; EXTERIOR FINISH SHALL BE A GRAY BRACK-ON ENAMEL OR LACQUER. APPLY ALL FINISH COATINGS OVER A RUST-INHIBITING METAL PRIMER.
- D. IDENTIFICATION: PROVIDE AN ENGRAVED LAMINATED PLASTIC NAMEPLATE IDENTIFYING THE EQUIPMENT AS DESIGNATED AND LOCATED ON THE CONTRACT DRAWINGS, AND INDICATING VOLTAGE, PHASE, AND NUMBER OF SYSTEM CONDUCTORS. FOR EXAMPLE, "SWITCHBOARD MS 277/480V. 3Ø 4W. LETTERING SHALL BE WHITE ON BLACK FINISH AND 2-INCH HIGH MINIMUM. NAMEPLATES SHALL BE AFFIXED BY A MINIMUM OF TWO ESCUTCHEON PINS OR SCREWS. EACH DEVICE ON THE EQUIPMENT SHALL BE PROVIDED WITH AN ENGRAVED PLASTIC NAMEPLATE AS SPECIFIED IN SECTION 16141, EQUIPMENT LABELS AND NAMEPLATES AND WARNING SIGNS.

PART 3 - EXECUTION

- 3.1 GENERAL INSTALLATION
- A. EQUIPMENT SHALL BE SECURELY BOLTED TO THE STRUCTURE. FINAL ATTACHMENT MEANS SHALL BE IN COMPLIANCE WITH THE SEISMIC REQUIREMENTS OF GOVERNING AUTHORITY. SHOP DRAWINGS INDICATING THE ATTACHMENT REQUIREMENTS SHALL BE PROVIDED BY THE MANUFACTURER ALONG WITH ALL NECESSARY CALCULATIONS AND SHALL BE SUBMITTED WITH THE SHOP DRAWINGS OF THE EQUIPMENT.
- B. EQUIPMENT SHALL BE INSTALLED IN A LEVEL AND "PLUMB" CONDITION.
- C. EQUIPMENT SHALL BE PROTECTED DURING CONSTRUCTION IN SUCH A MANNER TO PREVENT PLASTER, PAINT, DUST, ETC. FROM DEFACING THE FINISH OF EQUIPMENT. PRIOR TO FINAL ACCEPTANCE OF THE EQUIPMENT, THE INTERIOR OF THE EQUIPMENT SHALL BE CLEANED OF ALL FOREIGN MATERIALS AND DEBRIS. ANY BLEMISHES OR DEFECTS ON THE EXTERIOR OF THE EQUIPMENT SHALL BE REPAIRED BY PAINTING THE EQUIPMENT WITH PAINT SUPPLIED BY THE MANUFACTURER OF THE EQUIPMENT TO MATCH THE FACTORY FINISHES.
- D. NO OPERATING HANDLES SHALL BE LOCATED ABOVE 6-FOOT 6-INCHES ABOVE FINISH FLOOR. CODE CLEARANCES ON ALL SIDES OF THE EQUIPMENT SHALL BE MAINTAINED.
- E. EQUIPMENT SHALL BE MECHANICALLY GROUNDED TO THE GROUNDING SYSTEM.
- 3.2 ACCEPTANCE TESTING OF METERING EQUIPMENT
- A. GENERAL:
1. INSPECT FOR PHYSICAL DAMAGE.
 2. COMPARE EQUIPMENT NAMEPLATE INFORMATION WITH LATEST SINGLE LINE DIAGRAM.
 3. INSPECT FOR PROPER ALIGNMENT, ANCHORAGE AND GROUNDING.
 4. CHECK TIGHTNESS OF ACCESSIBLE BOLTED BUS JOINTS BY CALIBRATED TORQUE WRENCH METHOD. REFER TO MANUFACTURER'S INSTRUCTION FOR PROPER FOOT POUND LEVELS.
 5. ALL DOORS, PANELS AND SECTIONS SHALL BE INSPECTED FOR PAINT, DENTS, SCRATCHES.

END OF SECTION 16426

SECTION 16450 - GROUNDING

PART 1 - GENERAL

- 1.1 DESCRIPTION
- A. THIS SECTION SPECIFIES GENERAL GROUNDING AND BONDING REQUIREMENTS OF ELECTRICAL INSTALLATIONS FOR PERSONNEL SAFETY AND TO PROVIDE A LOW IMPEDANCE PATH FOR POSSIBLE GROUND FAULT CURRENTS AS DESCRIBED IN CEC ARTICLE 250.
- B. "GROUNDING ELECTRODE SYSTEM" REFERS TO ALL ELECTRODES REQUIRED BY CEC, AS WELL AS INCLUDING MADE, SUPPLEMENTARY, LIGHTNING PROTECTION SYSTEM AND TELECOMMUNICATIONS SYSTEM GROUNDING ELECTRODES.
- C. THE TERMS "CONNECT" AND "BOND" ARE USED INTERCHANGEABLY IN THIS SPECIFICATION AND HAVE THE SAME MEANING.
- 1.2 RELATED WORK
- A. SECTION 16050, BASIC MATERIALS AND METHODS.
- B. SECTION 16120, POWER WIRE, CABLES AND CONDUCTORS.
- PART 2 - PRODUCTS
- 2.1 GROUNDING AND BONDING CONDUCTORS
- A. EQUIPMENT GROUNDING CONDUCTORS SHALL BE UL 83 INSULATED STRANDED COPPER, EXCEPT THAT SIZES NO. 10 AWG AND SMALLER SHALL BE SOLID COPPER. INSULATION COLOR SHALL BE CONTINUOUS GREEN FOR ALL EQUIPMENT GROUNDING CONDUCTORS, EXCEPT THAT WIRE SIZES NO. 4 AWG AND LARGER SHALL BE PERMITTED TO BE IDENTIFIED PER CEC.
- B. BONDING CONDUCTORS SHALL BE ASTM B8 BARE STRANDED COPPER, EXCEPT THAT SIZES NO. 10 AWG AND SMALLER SHALL BE ASTM B1 SOLID BARE COPPER WIRE.
- C. CONDUCTORS SIZES SHALL NOT BE LESS THAN WHAT IS SHOWN ON THE DRAWINGS AND NOT LESS THAN REQUIRED BY THE CEC, WHICHEVER IS GREATER.
- 2.2 GROUND RODS
- A. COPPERCLAD STEEL, 2 INCH DIAMETER BY 10 FEET LONG, CONFORMING TO UL 467 UNLESS OTHERWISE NOTED ON DRAWINGS AND DETAILS.
- B. QUANTITY OF RODS SHALL BE AS REQUIRED TO OBTAIN THE SPECIFIED GROUND RESISTANCE OR ADDITIONAL RODS SHALL BE DRIVEN TO OBTAIN SPECIFIED RESISTANCE OR LESS.
- 2.3 SPLICES AND TERMINATION COMPONENTS
- A. COMPONENTS SHALL MEET OR EXCEED UL 467 AND BE CLEARLY MARKED WITH THE MANUFACTURER, CATALOG NUMBER, AND PERMITTED CONDUCTOR SIZE(S).

PART 3 - EXECUTION

- 3.1 GENERAL
- A. GROUND IN ACCORDANCE WITH THE CEC, AS SHOWN ON DRAWINGS, AND AS HEREINAFTER SPECIFIED.
- B. SYSTEM GROUNDING:
1. SECONDARY SERVICE NEUTRALS: GROUND AT THE SUPPLY SIDE OF THE SECONDARY DISCONNECTING MEANS AND AT THE RELATED TRANSFORMERS.
 2. SEPARATELY DERIVED SYSTEMS (TRANSFORMERS DOWNSTREAM FROM THE SERVICE ENTRANCE): GROUND THE SECONDARY NEUTRAL.
- C. EQUIPMENT GROUNDING: METALLIC STRUCTURES (INCLUDING DUCTWORK AND BUILDING STEEL), ENCLOSURES, FIRE SPRINKLERS, PLUMBING PIPING, RACEWAYS, JUNCTION BOXES, OUTLET BOXES, CABINETS, MACHINE FRAMES, AND OTHER CONDUCTIVE ITEMS IN CLOSE PROXIMITY WITH ELECTRICAL CIRCUITS SHALL BE BONDED AND GROUNDED.
- 3.2 INACCESSIBLE GROUNDING CONNECTIONS
- A. MAKE GROUNDING CONNECTIONS WHICH ARE BURIED OR OTHERWISE NORMALLY INACCESSIBLE (EXCEPT CONNECTIONS FOR WHICH PERIODIC TESTING ACCESS IS REQUIRED) BY EXOTHERMIC WELD.
- 3.3 SECONDARY EQUIPMENT AND CIRCUITS
- A. MAIN BONDING JUMPER: BOND THE SECONDARY SERVICE NEUTRAL TO THE GROUND BUS IN THE SERVICE EQUIPMENT.
- B. METALLIC PIPING, BUILDING STEEL, AND SUPPLEMENTAL ELECTRODE(S):
1. PROVIDE A GROUNDING ELECTRODE CONDUCTOR SIZED PER CEC BETWEEN THE SERVICE EQUIPMENT GROUND BUS AND ALL METALLIC WATER AND GAS PIPE SYSTEMS, BUILDING STEEL, AND SUPPLEMENTAL OR MADE ELECTRODES. JUMPER INSULATING JOINTS IN THE METALLIC PIPING. ALL CONNECTIONS TO ELECTRODES SHALL BE MADE WITH FITTINGS THAT CONFORM TO UL 467.
 2. PROVIDE A SUPPLEMENTAL GROUND ELECTRODE AND BOND TO THE GROUNDING ELECTRODE SYSTEM.
- C. SERVICE DISCONNECT: PROVIDE A GROUND BAR BOLTED TO THE ENCLOSURE WITH LUGS FOR CONNECTING THE VARIOUS GROUNDING CONDUCTORS.
- D. SWITCHGEAR AND SWITCHBOARDS:
1. CONNECT THE VARIOUS FEEDER EQUIPMENT GROUNDING CONDUCTORS TO THE GROUND BUS IN THE ENCLOSURE WITH SUITABLE PRESSURE CONNECTORS.
 2. FOR SERVICE ENTRANCE EQUIPMENT, CONNECT THE GROUNDING ELECTRODE CONDUCTOR TO THE GROUND BUS.
 3. CONNECT METALLIC CONDUITS, WHICH TERMINATE WITHOUT MECHANICAL CONNECTION TO THE HOUSING, BY GROUNDING BUSHINGS AND GROUNDING CONDUCTOR TO THE EQUIPMENT GROUND BUS.
- E. CONDUIT SYSTEMS:
1. GROUND ALL METALLIC CONDUIT SYSTEMS. ALL METALLIC CONDUIT SYSTEMS SHALL CONTAIN AN EQUIPMENT GROUNDING CONDUCTOR SIZED PER CEC.
 2. NON METALLIC CONDUIT SYSTEMS SHALL CONTAIN AN EQUIPMENT GROUNDING CONDUCTOR, EXCEPT THAT NON-METALLIC FEEDER CONDUITS WHICH CARRY A GROUNDED CONDUCTOR FROM EXTERIOR TRANSFORMERS TO INTERIOR OR BUILDING-MOUNTED SERVICE ENTRANCE EQUIPMENT NEED NOT CONTAIN AN EQUIPMENT GROUNDING CONDUCTOR.

3. METAL CONDUIT CONTAINING ONLY A GROUNDING CONDUCTOR, AND WHICH IS PROVIDED FOR MECHANICAL PROTECTION OF THE CONDUCTOR, SHALL BE BONDED TO THAT CONDUCTOR AT THE ENTRANCE AND EXIT FROM THE CONDUIT.
- F. FEEDERS AND BRANCH CIRCUITS: INSTALL EQUIPMENT GROUNDING CONDUCTORS WITH ALL FEEDERS, POWER AND LIGHTING BRANCH CIRCUITS.
- G. BOXES, CABINETS, ENCLOSURES, AND PANELBOARDS:
1. BOND THE EQUIPMENT GROUNDING CONDUCTOR TO EACH PULLBOX, JUNCTION BOX, OUTLET BOX, DEVICE BOX, CABINETS, AND OTHER ENCLOSURES THROUGH WHICH THE CONDUCTOR PASSES.
 2. PROVIDE LUGS IN EACH BOX AND ENCLOSURE FOR EQUIPMENT GROUNDING CONDUCTOR TERMINATION.
 3. PROVIDE GROUND BARS IN PANELBOARDS, BOLTED TO THE HOUSING, WITH SUFFICIENT LUGS TO TERMINATE THE EQUIPMENT GROUNDING CONDUCTORS.
- H. MOTORS AND STARTERS: PROVIDE LUGS IN MOTOR TERMINAL BOX AND STARTER HOUSING OR MOTOR CONTROL CENTER COMPARTMENT TO TERMINATE EQUIPMENT GROUNDING CONDUCTORS.
- I. RECEPTACLES SHALL NOT BE GROUNDED THROUGH THEIR MOUNTING SCREWS. GROUND WITH A JUMPER FROM THE RECEPTACLE GREEN GROUND TERMINAL TO THE DEVICE BOX GROUND SCREW AND THE BRANCH CIRCUIT EQUIPMENT GROUNDING CONDUCTOR.
- J. GROUND LIGHTING FIXTURES TO THE EQUIPMENT GROUNDING CONDUCTOR OF THE WIRING SYSTEM WHEN THE GREEN GROUND IS PROVIDED; OTHERWISE, GROUND THE FIXTURES THROUGH THE CONDUIT SYSTEMS. FIXTURES CONNECTED WITH FLEXIBLE CONDUIT SHALL HAVE A GREEN GROUND WIRE INCLUDED WITH THE POWER WIRES FROM THE FIXTURE THROUGH THE FLEXIBLE CONDUIT TO THE FIRST OUTLET BOX.
- K. FIXED ELECTRICAL APPLIANCES AND EQUIPMENT SHALL BE PROVIDED WITH A GROUND LUG FOR TERMINATION OF THE EQUIPMENT GROUNDING CONDUCTOR.

3.4 CONDUCTIVE PIPING

- A. BOND ALL CONDUCTIVE PIPING SYSTEMS, INTERIOR AND EXTERIOR, TO THE BUILDING TO THE GROUNDING ELECTRODE SYSTEM. BONDING CONNECTIONS SHALL BE MADE AS CLOSE AS PRACTICAL TO THE EQUIPMENT GROUND BUS.
- 3.5 GROUND RESISTANCE
- A. GROUNDING SYSTEM RESISTANCE TO GROUND SHALL NOT EXCEED 25 OHMS. MAKE NECESSARY MODIFICATIONS OR ADDITIONS TO THE GROUNDING ELECTRODE SYSTEM FOR COMPLIANCE WITHOUT ADDITIONAL COST TO THE OWNER. FINAL TESTS SHALL ASSURE THAT THIS REQUIREMENT IS MET.
- B. RESISTANCE OF THE GROUNDING ELECTRODE SYSTEM SHALL BE MEASURED USING A FOUR-TERMINAL FALL-OFF-POTENTIAL METHOD AS DEFINED IN IEEE STANDARD 81. GROUND RESISTANCE MEASUREMENTS SHALL BE MADE BEFORE THE ELECTRICAL DISTRIBUTION SYSTEM IS ENERGIZED AND SHALL BE MADE IN NORMALLY DRY CONDITIONS NOT LESS THAN 48 HOURS AFTER THE LAST RAINFALL. RESISTANCE MEASUREMENTS OF SEPARATE GROUNDING ELECTRODE SYSTEMS SHALL BE MADE BEFORE THE SYSTEMS ARE BONDED TOGETHER BELOW GRADE. THE COMBINED RESISTANCE OF SEPARATE SYSTEMS MAY BE USED TO MEET THE REQUIRED RESISTANCE, BUT THE SPECIFIED NUMBER OF ELECTRODES MUST STILL BE PROVIDED.
- C. SERVICES AT PACIFIC GAS AND ELECTRIC COMPANY INTERFACE POINT SHALL COMPLY WITH THEIR GROUND RESISTANCE REQUIREMENTS.
- D. BELOW-GRADE CONNECTIONS SHALL BE VISUALLY INSPECTED BY THE IOR PRIOR TO BACKFILLING. THE CONTRACTOR SHALL NOTIFY THE IOR 24 HOURS BEFORE THE CONNECTIONS ARE READY FOR INSPECTION.
- E. FURNISH A COPY OF TESTS TO OWNER AT COMPLETION OF PROJECT.
- 3.6 GROUND ROD INSTALLATION
- A. DRIVE EACH ROD VERTICALLY IN THE EARTH, NOT LESS THAN 9.5 FEET IN DEPTH.
- B. WHERE PERMANENTLY CONCEALED GROUND CONNECTIONS ARE REQUIRED, MAKE THE CONNECTIONS BY THE EXOTHERMIC PROCESS TO FORM SOLID METAL JOINTS. MAKE ACCESSIBLE GROUND CONNECTIONS WITH MECHANICAL PRESSURE TYPE GROUND CONNECTORS.
- C. WHERE ROCK PREVENTS THE DRIVING OF VERTICAL GROUND RODS, INSTALL ANGLED GROUND RODS OR GROUNDING ELECTRODES IN HORIZONTAL TRENCHES TO ACHIEVE THE SPECIFIED RESISTANCE.

END OF SECTION 16450

SECTION 16510 - BUILDING LIGHTING, INTERIOR

PART 1 - GENERAL

- 1.1 DESCRIPTION
- A. THIS SECTION SPECIFIES THE FURNISHING, INSTALLATION AND CONNECTION OF THE INTERIOR LIGHTING SYSTEMS, INCLUDING LUMINAIRES, BALLASTS, LAMPS AND EMERGENCY LIGHTING EQUIPMENT.
- PART 2 - PRODUCTS
- 2.1 EMERGENCY FLUORESCENT LAMP POWER SUPPLY:
- A. SELF-CONTAINED BATTERY-OPERATED POWER SUPPLY FOR OPERATING ONE T8 OR COMPACT FLUORESCENT LAMP FOR A MINIMUM OUTPUT OF 90 MINUTES.
- B. THE POWER SUPPLY SHALL BE INSTALLED WITHIN THE LUMINAIRE BALLAST COMPARTMENT OR WIREWAY. PROVIDE WITH TEST SWITCH AND CHARGE INDICATOR INSTALLED INTEGRAL TO THE LUMINAIRE. THE TEST SWITCH AND CHARGE INDICATOR MAY BE INSTALLED IN A REMOTE CEILING MOUNTED FLUSH J-BOX FOR RECESSED DOWNLIGHTS WHICH CANNOT ACCEPT INTEGRAL COMPONENTS.
- C. PERFORMANCE: EMERGENCY OPERATION LUMEN OUTPUT FOR LINEAR FLUORESCENT LAMPS SHALL BE A MINIMUM OF 1100 LUMENS, AND FOR COMPACT FLUORESCENT LAMPS SHALL BE A MINIMUM OF 640 LUMENS, UNLESS SPECIFICALLY NOTED OTHERWISE ON THE ASSOCIATED ELECTRICAL DRAWINGS.
- D. PROVIDE ACCESS HATCHES, FOR EMERGENCY BATTERY BACKUP BALLASTS, ADJACENT TO RECESSED 6-INCH OR LESS DIAMETER DOWNLIGHTS INSTALLED IN INACCESSIBLE CEILINGS.
- E. MANUFACTURERS: BODINE, IOTA, OR APPROVED. EMERGENCY FLUORESCENT LAMP POWER SUPPLIES MAY BE PROVIDED AS FACTORY INSTALLED BY THE LUMINAIRE MANUFACTURER PROVIDED THE PRODUCT MEETS THE ABOVE SPECIFICATION CRITERIA.
- 2.2 LIGHTING FIXTURES (LUMINAIRES)
- A. SHALL BE IN ACCORDANCE WITH NFPA 70, UL 1598 AND SHALL BE AS SHOWN ON DRAWINGS AND AS SPECIFIED. ALL LUMINAIRES SHALL HAVE BEEN CERTIFIED TO THE CALIFORNIA ENERGY COMMISSION BY ITS MANUFACTURER TO COMPLY WITH THE EFFICIENCY STANDARDS AS PER CALIFORNIA CODE OF REGULATIONS TITLE 24, PART 6, SECTION 11.1 REFERENCING THE APPLIANCE EFFICIENCY REGULATIONS IN TITLE 20. POST CERTIFICATION WITH BUILDING PERMIT.

B. SHEET METAL:

1. SHALL BE FORMED TO PREVENT WARPING AND SAGGING. HOUSING, TRIM AND LENS FRAME SHALL BE TRUE, STRAIGHT (UNLESS INTENTIONALLY CURVED) AND PARALLEL TO EACH OTHER AS DESIGNED.
 2. WIREWAYS AND FITTINGS SHALL BE FREE OF BURRS AND SHARP EDGES AND SHALL ACCOMMODATE INTERNAL AND BRANCH CIRCUIT WIRING WITHOUT DAMAGE TO THE WIRING.
 3. WHEN INSTALLED, ANY EXPOSED FIXTURE HOUSING SURFACE, TRIM FRAME, DOOR FRAME AND LENS FRAME SHALL BE FREE OF LIGHT LEAKS; LENS DOORS SHALL CLOSE IN A LIGHT TIGHT MANNER.
- A. HINGED DOOR CLOSURE FRAMES SHALL OPERATE SMOOTHLY WITHOUT BINDING WHEN THE FIXTURE IS IN THE INSTALLED POSITION, AND LATCHES SHALL FUNCTION EASILY BY FINGER ACTION WITHOUT THE USE OF TOOLS.
- B. LUMINAIRES INSTALLED UNDER CANOPIES, ROOF OR OPEN PORCHES AND SIMILAR DAMP OR WET LOCATION SHALL BE U.L. LABELED AS SUITABLE FOR DAMP OR WET LOCATION.
- C. BALLASTS SHALL BE SERVICEABLE WHILE THE FIXTURE IS IN ITS NORMALLY INSTALLED POSITION, AND SHALL NOT BE MOUNTED TO REMOVABLE REFLECTORS OR WIREWAY COVERS UNLESS SO SPECIFIED.
- D. LAMP SOCKETS:
1. FLUORESCENT: LAMPHOLDER CONTACTS SHALL BE THE BITING EDGE TYPE OR PHOSPHOROUS BRONZE WITH SILVER FLASH CONTACT SURFACE TYPE AND SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF UL 542. CONTACTS FOR RECESSED DOUBLE CONTACT LAMP HOLDERS AND FOR SLIMLINE LAMP HOLDERS SHALL BE SILVER PLATED. LAMP HOLDERS FOR BI PIN LAMPS, WITH THE EXCEPTION OF THOSE FOR "U" TYPE LAMPS, SHALL BE OF THE TELESCOPING COMPRESSION TYPE, OR OF THE SINGLE SLOT ENTRY TYPE REQUIRING A ONE QUARTER TURN OF THE LAMP AFTER INSERTION.
 2. INCANDESCENT: SHALL HAVE PORCELAIN ENCLOSURES AND CONFORM TO THE APPLICABLE REQUIREMENTS OF UL 496.
 3. HIGH INTENSITY DISCHARGE (H.I.D.): SHALL HAVE PORCELAIN ENCLOSURES.

- E. RECESSED FIXTURES SHALL BE OF THE TYPE APPROVED FOR THE CEILING AND INSULATION CONDITIONS AND APPROPRIATE FOR THE INSTALLATION LOCATION. INSULATION MUST BE HELD BACK FROM THE FIXTURE TO PROVIDE MANUFACTURERS' RECOMMENDED CLEARANCES FOR PROPER OPERATION. THERMAL TRIPPING SHALL BE THE INSTALLER'S RESPONSIBILITY TO CORRECT. WHERE INSTALLED IN FIRE RATED CEILINGS, COORDINATE INSTALLATION OF FIRE RATED ENCLOSURES AROUND THE CEILING PENETRATIONS. FIXTURES SHALL CONTAIN THE PROPER THROUGH WIRING CAPACITY FOR THAT WHICH IS SHOWN ON THE PLANS.
- F. RECESSED FIXTURES SHALL BE PROVIDED WITH THE APPROPRIATE TRIMS AND HARDWARE COMPATIBLE WITH THE CEILING TYPE SHOWN. PLASTER FRAMES ARE REQUIRED WHERE PLASTER OR GYPSUM BOARD CEILINGS ARE ENCOUNTERED.
- G. FLUORESCENT FIXTURES WITH LOUVERS OR LIGHT TRANSMITTING PANELS SHALL HAVE HINGES, LATCHES AND SAFETY CATCHES TO FACILITATE SAFE, CONVENIENT CLEANING AND RELAMPING. VAPOR TIGHT FIXTURES SHALL HAVE PRESSURE CLAMPING DEVICES IN LIEU OF THE LATCHES.
- H. MECHANICAL SAFETY: LIGHTING FIXTURE CLOSURES (LENS DOORS, TRIM FRAME, HINGED HOUSINGS, ETC.) SHALL BE RETAINED IN A SECURE MANNER BY CAPTIVE SCREWS, CHAINS, CAPTIVE HINGES OR FASTENERS SUCH THAT THEY CANNOT BE ACCIDENTALLY DISLODGED DURING NORMAL OPERATION OR ROUTINE MAINTENANCE.
- I. METAL FINISHES:

1. THE MANUFACTURER SHALL APPLY STANDARD FINISH (UNLESS OTHERWISE SPECIFIED) OVER A CORROSION RESISTANT PRIMER, AFTER CLEANING TO FREE THE METAL SURFACES OF RUST, GREASE, DIRT AND OTHER DEPOSITS. EDGES OF PRE-FINISHED SHEET METAL EXPOSED DURING FORMING, STAMPING OR SHEARING PROCESSES SHALL BE FINISHED IN A SIMILAR CORROSION RESISTANT MANNER TO MATCH THE ADJACENT SURFACE(S). FIXTURE FINISH SHALL BE FREE OF STAINS OR EVIDENCE OF RUSTING, BLISTERING, OR FLAKING.
 2. INTERIOR LIGHT REFLECTING FINISHES SHALL BE WHITE WITH NOT LESS THAN 85 PERCENT REFLECTANCES, EXCEPT WHERE OTHERWISE SPECIFIED ON THE DRAWING.
 3. EXTERIOR FINISHES SHALL BE AS SHOWN ON THE DRAWINGS.
- J. PROVIDE ALL LIGHTING FIXTURES WITH A SPECIFIC MEANS FOR GROUNDING METALLIC WIREWAYS AND HOUSINGS TO AN EQUIPMENT GROUNDING CONDUCTOR.
- K. LIGHT TRANSMITTING COMPONENTS FOR FLUORESCENT FIXTURES:
1. SHALL BE 100 PERCENT VIRGIN ACRYLIC PLASTIC OR WATER WHITE, ANNEALED, CRYSTAL GLASS.
 2. FLAT LENS PANELS SHALL HAVE NOT LESS THAN 1/8 INCH OF AVERAGE THICKNESS. THE AVERAGE THICKNESS SHALL BE DETERMINED BY ADDING THE MAXIMUM THICKNESS TO THE MINIMUM UNPENETRATED THICKNESS AND DIVIDING THE SUM BY 2.
 3. UNLESS OTHERWISE SPECIFIED, LENSES, DIFFUSERS AND LOUVERS SHALL BE RETAINED FIRMLY IN A METAL FRAME BY CLIPS OR CLAMPING RING IN SUCH A MANNER AS TO ALLOW EXPANSION AND CONTRACTION OF THE LENS WITHOUT DISTORTION OR CRACKING.
- L. COMPACT FLUORESCENT FIXTURES SHALL BE MANUFACTURED SPECIFICALLY FOR COMPACT FLUORESCENT LAMPS WITH BALLASTS INTEGRAL TO THE FIXTURE. ASSEMBLIES DESIGNED TO RETROFIT INCANDESCENT FIXTURES ARE PROHIBITED EXCEPT WHEN DESCRIBED IN THIS FINISH. FIXTURES SHALL BE DESIGNED FOR LAMPS AS SPECIFIED.

2.3 BALLASTS

- A. BALLASTS, GENERAL:
1. PROVIDE BALLASTS RATED FOR SPECIFIED LAMPS, I.E., T-8 RATED BALLASTS WHERE T-8 LAMPS SPECIFIED;
 2. THERMAL PROTECTION: INTERNAL UL CLASS P WITH AUTOMATIC RESET.
 3. POWER FACTOR: NOT LESS THAN 90 PERCENT UNLESS OTHERWISE INDICATED.
 4. SOUND RATINGS: RATING A, EXCEPT WHERE NOT AVAILABLE AS STANDARD PRODUCTS FROM ANY MANUFACTURER. PROVIDE QUIETEST RATINGS AVAILABLE.
 5. INPUT VOLTAGE: MATCH BRANCH CIRCUIT SUPPLY VOLTAGE; REFER TO DRAWINGS.
 6. PROVIDE NUMBER OF BALLASTS IN LUMINAIRES TO PROVIDE MULTILEVEL SWITCHING AS INDICATED ON DRAWINGS.
- B. FLUORESCENT ELECTRONIC BALLASTS:
1. PROVIDE BALLASTS WHICH MEET REQUIREMENTS OF UL 935 LISTED CLASS P TYPE 1, UL TYPE GC ANTI-ARCO RATED, THERMALLY PROTECTED AND RECOGNIZED BY CERTIFIED BALLAST MANUFACTURER (CBM) AND BEAR THE APPROPRIATE UL LABEL.
 2. ELECTRICAL CHARACTERISTICS:
 - A. PROVIDE ELECTRONIC BALLASTS WHICH WITHSTAND INPUT POWER LINE TRANSIENTS AS DEFINED IN ANSI C62.41, CATEGORY-A AND IEEE 587. MULTI-VOLTAGE CONTROL CAPABILITIES FROM 108 VOLT TO 305 VOLT.
 - B. POWER FACTOR: 95 PERCENT OR HIGHER.
 - C. MINIMUM 0.77 BALLAST FACTOR.
 - D. TOTAL HARMONIC DISTORTION: NOT TO EXCEED 10 PERCENT OF THE INPUT CURRENT.
 - E. COMPLY WITH FCC RULES AND REGULATIONS PART 18, CLASS A CONCERNING GENERATION OF BOTH ELECTROMAGNETIC INTERFERENCE AND RADIO FREQUENCY INTERFERENCE.
 - F. PROVIDE RATED INITIAL AND MEAN LUMEN OUTPUT WITH SYSTEM CONFIGURATION PROVIDED.

- C. ALL BALLASTS SHALL HAVE BEEN CERTIFIED TO THE CALIFORNIA ENERGY COMMISSION BY ITS MANUFACTURER TO COMPLY WITH THE EFFICIENCY STANDARDS AS PER CALIFORNIA CODE OR REGULATION TITLE 24, PART 6, SECTION 11.1 REFERENCING THE APPLIANCE EFFICIENCY REGULATIONS IN TITLE 20. POST CERTIFICATION WITH BUILDING PERMIT.

- D. PERFORMANCE: BALLASTS SHALL CARRY A MINIMUM FULL 5 YEAR WARRANTY. ALL BALLASTS SHALL HAVE A CLASS A SOUND RATING. ANY BALLAST DEEMED NOISY BY THE ARCHITECT SHALL BE REPLACED AT NO CHARGE TO THE OWNER.
- E. SHIELDING: ALL LENS MATERIAL SHALL BE 100% VIRGIN ACRYLIC, .125" MINIMUM THICKNESS, UNLESS OTHERWISE INDICATED IN THE FIXTURE SCHEDULE. DIFFUSERS SHALL COMPLY WITH UBC 5209.
- F. SLIMLINE AND MAGNETIC BALLASTS SHALL NOT BE ALLOWED.
- G. MAINTAIN ACCESSIBILITY OF ALL BALLAST LOCATIONS.
- H. FLUORESCENT DIMMING BALLASTS:
1. DIMMING RANGE 100 PERCENT TO 5 PERCENT.
 2. POWER FACTOR GREATER THAN 95 PERCENT.
 3. THD LESS THAN 10 PERCENT.
 4. NO VISIBLE LAMP FLICKER.
 5. MANUFACTURER: ADVANCE MARK 10 SERIES.

2.4 LAMPS

- A. PROVIDE LAMPS FOR ALL LUMINAIRES.
- B. FLUORESCENT LAMPS:
1. ALL FLUORESCENT LAMPS SHALL BE SECOND GENERATION T8 LAMPS RATED AT MINIMUM 3100 LUMEN OUTPUT, 4100K MINIMUM CRI 85, LENGTH AND WATTAGE AS NOTED IN LUMINAIRE SCHEDULE. GE F32T8/XL/SPX41/HL/ECO, OSRAM/SYLVANIA F032/84XP5/ECO, PHILLIPS F32T8/ADV841/ALTO, 24,000 HOUR RATED MINIMUM LAMP LIFE.
 2. COMPACT FLUORESCENT LAMPS: QUAD TUBE, 4100K MINIMUM CRI 85 UNLESS OTHERWISE NOTED. GENERAL ELECTRIC, OSRAM/SYLVANIA, PHILLIPS, 10,000 HOUR LIFE MINIMUM.
 3. PROVIDE FLUORESCENT LAMPS BY SAME MANUFACTURER GENERAL ELECTRIC, OSRAM/SYLVANIA, PHILLIPS.
- C. INCANDESCENT: 130 VOLT RATED. GENERAL ELECTRIC, OSRAM/SYLVANIA, PHILLIPS.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- A. INSTALLATION AND FURNISHING OF LIGHTING FIXTURES SHALL BE IN ACCORDANCE WITH THE CEC, MANUFACTURER'S INSTRUCTIONS AND AS SHOWN ON THE DRAWINGS OR SPECIFIED. FIXTURES DAMAGED IN TRANSIT AND STORAGE PRIOR TO COMPLETION SHALL BE REPLACED AT CONTRACTOR'S EXPENSE.
- B. ALIGN, MOUNT AND LEVEL THE LIGHTING FIXTURES UNIFORMLY.
- C. AVOID INTERFERENCE WITH AND PROVIDE CLEARANCE FOR EQUIPMENT, WHERE THE INDICATED LOCATIONS FOR THE LIGHTING FIXTURES CONFLICT WITH THE LOCATIONS FOR EQUIPMENT, CHANGE THE LOCATIONS FOR THE LIGHTING FIXTURES BY THE MINIMUM DISTANCES NECESSARY AS APPROVED BY THE ARCHITECT. THE ARCHITECTURAL REFLECTED CEILING PLAN WILL TAKE PRECEDENCE OVER ELECTRICAL PLANS.
- D. FOR SUSPENDED LIGHTING FIXTURES, THE MOUNTING HEIGHTS SHALL PROVIDE THE CLEARANCES BETWEEN THE BOTTOMS OF THE FIXTURES AND THE FINISHED FLOORS AS SHOWN ON THE DRAWINGS.
- E. LIGHTING FIXTURE SUPPORTS:
1. CONTRACTOR SHALL PROVIDE SUPPORT FOR ALL OF THE FIXTURES INDEPENDENT OF SUSPENDED CEILINGS. SUPPORTS MAY BE ANCHORED TO CHANNELS OF THE CEILING CONSTRUCTION, TO THE STRUCTURAL SLAB OR TO STRUCTURAL MEMBERS WITHIN A PARTITION, OR ABOVE A SUSPENDED CEILING.
 2. SHALL MAINTAIN THE FIXTURE POSITIONS AFTER CLEANING AND RELAMPING.

3. SHALL SUPPORT THE LIGHTING FIXTURES WITHOUT CAUSING THE CEILING OR PARTITION TO DEFLECT.
4. HARDWARE FOR RECESSED FLUORESCENT FIXTURES:
 - A. FIXTURES SHALL BE SUPPORTED AS DETAILED ON DRAWINGS
 - B. INSTALLATION: FIXTURES SHALL BE SECURELY MOUNTED ON CEILINGS AND WALLS WITH APPROPRIATE FASTENING DEVICES. "DROP-IN" TYPE T-BAR FIXTURES SHALL BE SECURED WITH #12 GAUGE SAFETY "EARTHQUAKE WIRES" AS DESCRIBED BY CALIFORNIA CODE OF REGULATIONS TITLE 24 PART 2, CHAPTER 47. "EARTHQUAKE CLIPS" WILL BE REQUIRED FOR FASTENING TO THE T-BAR SYSTEM IN ADDITION TO SAFETY WIRE. SURFACE MOUNTED FLUORESCENT FIXTURES SHALL BE SOLIDLY SCREWED OR CLIPPED INTO FRAMING ABOVE DRYWALL WITH 4-#10 SHEET METAL SCREWS INTO EACH FIXTURE. PROVIDE BLOCKING FOR SCREW SUPPORTS BEHIND ALL SURFACE MOUNTED LIGHTING FIXTURES MORE THAN 15 LBS.
5. A. FIXTURES SHALL BE BOLTED AGAINST THE CEILING INDEPENDENT OF THE OUTLET BOX AT FOUR POINTS SPACED NEAR THE CORNERS OF EACH UNIT. THE BOLTS SHALL BE MINIMUM 3/4-20 BOLT, SECURED TO STRUCTURAL CEILING. NON-TURNING STUDS MAY BE ATTACHED TO THE BUILDING STRUCTURE BY 12 GAUGE SAFETY HANGERS.
6. FIXTURES MOUNTED IN OPEN CONSTRUCTION SHALL BE SECURED DIRECTLY TO THE BUILDING STRUCTURE WITH APPROVED BOLTING AND CLAMPING DEVICES.
7. SINGLE OR DOUBLE PENDENT MOUNTED LIGHTING FIXTURES:
 - A. EACH STEM SHALL BE SUPPORTED BY AN APPROVED OUTLET BOX, MOUNTED SWIVEL JOINT AND CANOPY WHICH HOLDS THE STEM CATCH AND PROVIDES SPRING LOAD (OR APPROVED EQUIVALENT) DAMPENING OF FIXTURE OSCILLATIONS. OUTLET BOX SHALL BE SUPPORTED VERTICALLY FROM THE BUILDING STRUCTURE AND BE ALLOWED TO SWING TO A 45 DEGREE ANGLE.
 - B. OUTLET BOXES FOR SUPPORT OF LIGHTING FIXTURES (WHERE PERMITTED) SHALL BE SECURED DIRECTLY TO THE BUILDING STRUCTURE WITH APPROVED DEVICES OR SUPPORTED VERTICALLY IN A HUNG CEILING FROM THE BUILDING STRUCTURE WITH A NINE GAUGE WIRE HANGER, AND BE SECURED BY AN APPROVED DEVICE TO A MAIN CEILING RUNNER OR CROSS RUNNER TO PREVENT ANY HORIZONTAL MOVEMENT RELATIVE TO THE CEILING.
 - F. FURNISH AND INSTALL THE SPECIFIED LAMPS FOR ALL LIGHTING FIXTURES AS PART OF THIS PROJECT.
 - G. COORDINATE BETWEEN THE ELECTRICAL AND CEILING TRADES TO ASCERTAIN THAT APPROVED LIGHTING FIXTURES ARE FURNISHED IN THE PROPER SIZES AND INSTALLED WITH THE PROPER DEVICES (HANGERS, CLIPS, TRIM FRAMES, FLANGES), TO MATCH THE CEILING SYSTEM BEING INSTALLED.
 - H. BOND LIGHTING FIXTURES AND METAL ACCESSORIES TO THE GROUNDING SYSTEM AS SPECIFIED IN SECTION 16450, GROUNDING.
8. I. AT COMPLETION OF PROJECT, RELAMP ALL FIXTURES WHICH HAVE FAILED/BURNED-OUT LAMPS. CLEAN ALL FIXTURES, LENSES, DIFFUSERS AND LOUVERS THAT HAVE ACCUMULATED DUST/DIRT DURING CONSTRUCTION.
- J. PROVIDE UNSWITCHED LEG OF INTERIOR LIGHTING BRANCH CIRCUIT TO INTEGRAL EMERGENCY BATTERY PACK LIGHT FIXTURES, EXIT SIGNS AND NIGHT LIGHTS AS APPLICABLE PER LIGHTING PLANS.
- K. WALLMOUNT FIXTURES IN WALKWAY AREAS SHALL NOT PROJECT MORE THAN 4 INCHES FROM WALL WHEN PROJECTION OCCURS LOWER THAN 80 INCHES.

END OF SECTION 16510

SECTION 16520 - SITE LIGHTING

PART 1 - GENERAL

- 1.1 DESCRIPTION
- THIS SECTION SPECIFIES THE FURNISHING, INSTALLATION, AND CONNECTION OF EXTERIOR LUMINAIRES, CONTROLS, POLES AND SUPPORTS.
- 1.2 RELATED WORK
- A. SECTION 16050, BASIC MATERIALS AND METHODS.
 - B. SECTION 16110, RACEWAYS: CONDUITS, FITTINGS, AND BOXES FOR RACEWAY SYSTEMS.
 - C. SECTION 16120, POWER WIRE, CABLES AND CONDUCTORS, LOW VOLTAGE (600 VOLTS AND BELOW): LOW VOLTAGE POWER AND LIGHTING WIRING.
 - D. SECTION 16402, UNDERGROUND ELECTRICAL CONSTRUCTION AND SERVICE: UNDERGROUND HANDHOLES AND CONDUITS.
- E. SECTION 16403, GROUNDING REQUIREMENTS FOR PERSONNEL SAFETY AND TO PROVIDE A LOW IMPEDANCE PATH FOR POSSIBLE GROUND FAULT CURRENTS.
- F. SECTION 16510, BUILDING LIGHTING, INTERIOR.
- 1.3 SUBMITTALS
- A. SUBMIT IN ACCORDANCE WITH SECTION 16050, BASIC MATERIALS AND METHODS.
 - B. SHOP DRAWINGS:
 1. SUFFICIENT INFORMATION, CLEARLY PRESENTED, SHALL BE INCLUDED TO DETERMINE COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.
 2. INCLUDE ELECTRICAL RATINGS, DIMENSIONS, MOUNTING, DETAILS, MATERIALS, REQUIRED CLEARANCES, TERMINATIONS, WIRING AND CONNECTION DIAGRAMS, PHOTOMETRIC DATA, BALLASTS, POLES, LUMINAIRES, LAMPS AND CONTROLS.
- 1.4 APPLICABLE PUBLICATIONS
- A. PUBLICATIONS LISTED BELOW (INCLUDING AMENDMENTS, ADDENDA, REVISIONS, SUPPLEMENTS) FORM A PART OF THIS SPECIFICATION TO THE EXTENT REFERENCED. PUBLICATIONS ARE REFERENCED IN THE TEXT BY THE BASIC DESIGNATION ONLY.
 - B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).
 - C. AMERICAN CONCRETE INSTITUTE (ACI).
 - D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).
 - E. ALUMINUM ASSOCIATION INC. (AA).
 - F. ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA).
 - G. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA).
 - H. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA).
 - I. UNDERWRITERS LABORATORIES, INC. (UL).

PART 2 - PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT
- MATERIALS AND EQUIPMENT SHALL BE IN ACCORDANCE WITH CEC, UL, ANSI, AND AS SHOWN ON THE DRAWINGS AND SPECIFIED.
- 2.2 LUMINAIRES
- A. UL 1598 AND ANSI C136.17. LUMINAIRES SHALL BE WEATHERPROOF, HEAVY DUTY, OUTDOOR TYPES DESIGNED FOR EFFICIENT LIGHT UTILIZATION, ADEQUATE DISSIPATION OF LAMP AND BALLAST HEAT AND SAFE CLEANING AND RELAMPING.
 - B. IESNA HB-9 AND RP-8 LIGHT DISTRIBUTION PATTERN TYPES SHALL BE AS SHOWN ON THE DRAWINGS.
 - C. INCORPORATE BALLASTS IN THE LUMINAIRE HOUSING EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS.
 - D. LENSES SHALL BE FRAME-MOUNTED HEAT-RESISTANT, BOROSILICATE GLASS, PRISMATIC REFRACTORS. ATTACH THE FRAME TO THE LUMINAIRE HOUSING BY HINGES OR CHAIN.
 - E. PRE-WIRE INTERNAL COMPONENTS TO TERMINAL STRIPS AT THE FACTORY.
 - F. BRACKET MOUNTED LUMINAIRES SHALL HAVE LEVELING PROVISIONS AND CLAMP TYPE ADJUSTABLE SLIP-FITTERS WITH LOCKING SCREWS.
 - G. MATERIALS SHALL BE RUSTPROOF. LATCHES AND FITTINGS SHALL BE NON-FERROUS METAL.
- 2.3 LAMPS
- A. INSTALL THE PROPER LAMPS IN EVERY LUMINAIRE INSTALLED.
 - B. LAMPS TO BE GENERAL-SERVICE, OUTDOOR LIGHTING TYPES.
- PART 3 - EXECUTION
- 3.1 INSTALLATION
- A. INSTALL LIGHTING IN ACCORDANCE WITH THE CEC, AS SHOWN ON THE DRAWINGS, AND IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
- 3.2 GROUNDING
- GROUND NONCURRENT-CARRYING PARTS OF EQUIPMENT INCLUDING METAL POLES, LUMINAIRES, MOUNTING ARMS, BRACKETS, AND METALLIC ENCLOSURES AS SPECIFIED IN SECTION 16450, GROUNDING. WHERE COPPER GROUNDING CONDUCTOR IS CONNECTED TO A METAL OTHER THAN COPPER, PROVIDE SPECIALLY TREATED OR ALLOYED CONNECTORS SUITABLE AND LISTED FOR THIS PURPOSE.

END OF SECTION 16520

PROJECT

ACCESSIBILITY IMPROVEMENTS

ROLLING HILLS APARTMENTS

TEMPLETON, CA

CLIENT JOB # ARCHITECT JOB #
0708B



PROJECT MANAGER JT

DRAWN BY DM

DATES	FIRST SUBMITTAL	5/28/10
	PLAN CHECK 1	8/16/10

SIGNED

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EXPIRES: 06/30/11
THOMA #10-8055

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SHEET TITLE
ELECTRICAL SPECIFICATIONS

SHEET #
E5.3