

SECTION 16141 – EQUIPMENT LABELS AND NAMEPLATES AND WARNING SIGNS

- PART 1 – GENERAL**
- 1.1 DESCRIPTION
- A. PROVIDE ALL LABOR MATERIALS AND EQUIPMENT NECESSARY FOR NAMEPLATES AND WARNING SIGNS WHERE SPECIFIED HEREIN AND AS SHOWN ON CONTRACT DOCUMENTS INCLUDING THE FOLLOWING:
1. NAMEPLATES AND WARNING SIGNS PERMANENTLY INSTALLED ON ALL ELECTRICAL EQUIPMENT AND DEVICES INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING ITEMS: ENCLOSURES FOR TRANSFORMERS, SWITCHBOARDS, MOTOR CONTROL PANELS, PULLBOXES, CABINETS, MOTORS, GENERATORS, TRANSFER SWITCHES.
 2. ENCLOSURES FOR ALL SEPARATELY ENCLOSED DEVICES INCLUDING, BUT NOT LIMITED TO, DISCONNECT SWITCHES, CIRCUIT BREAKERS, CONTACTORS, TIME SWITCHES, CONTROL STATIONS AND RELAYS, FIRE ALARM PANELS AND LIGHTING CONTROL PANEL.
 3. WALL SWITCHES NOT WITHIN SIGHT OF OUTLET CONTROLLED.
 4. SPECIAL SYSTEMS SUCH AS, BUT NOT LIMITED TO, TELEPHONE, FIRE ALARM, WARNING AND SIGNAL SYSTEMS. IDENTIFICATION SHALL BE AT EACH EQUIPMENT RACK, TERMINAL CABINET, CONTROL PANEL, ANNUNCIATOR AND PULLBOX.
 5. DEVICES MOUNTED WITHIN AND PART OF EQUIPMENT INCLUDING CIRCUIT BREAKERS, SWITCHES, CONTROL DEVICES, CONTROL TRANSFORMERS, RELAYS, INDICATION DEVICES AND INSTRUMENTS.
- 1.2 RELATED WORK
- A. SECTION 16050, BASIC MATERIALS AND METHODS.
 - B. SECTION 16160, PANELBOARDS.
 - C. SECTION 16170, SWITCHES, DISCONNECT AND SAFETY.
 - D. SECTION 16426, SERVICE AND DISTRIBUTION SWITCHBOARD.
- PART 2 – PRODUCTS**
- 2.1 EQUIPMENT LABEL DESIGNATIONS
- A. EQUIPMENT LABELS INDICATING EQUIPMENT DESIGNATIONS. DESIGNATION DATA PER DRAWINGS OR TO BE SUPPLIED WITH SHOP DRAWINGS APPROVAL.
- B. PANELBOARD LABELS SHOWING PANEL DESIGNATION, VOLTAGE, PHASE AND SOURCE.
- C. IN ACCORDANCE WITH CEC 110.16, PROVIDE ARC FLASH PROTECTION WARNING LABELS ON ALL SWITCHBOARDS, PANELBOARDS, DISTRIBUTION PANELS, TRANSFORMERS, SAFETY SWITCHES, ETC. LABELS SHALL BE PER ANSI Z535.4 GUIDELINES.
- 2.2 MATERIALS
- A. FOR LABELS: THREE LAYER LAMINATED PLASTIC OR MICARTA WITH ENGRAVED WHITE LETTERS OVER BLACK BACKGROUND.
 - B. FOR WARNING SIGNS: MINIMUM 18 GAUGE STEEL WITH RED LETTERING ON WHITE PORCELAIN ENAMEL FINISH.
 - C. ARC FLASH LABELS SHALL BE PROVIDED AS REQUIRED BY CEC ARTICLE 70E.
- PART 3 – EXECUTION**
- 3.1 MOUNTING
- A. EQUIPMENT LABELS SHALL BE MOUNTED BY SELF-TAPPING, THREADED SCREWS AND BOLTS, OR BY RIVETS. ADHESIVE TYPES ARE NOT ACCEPTABLE UNLESS SPECIFICALLY NOTED IN THIS SECTION.
- 3.2 HEIGHTS ON LABELS
- A. PANELBOARDS, SWITCHBOARDS AND MOTOR CONTROL CENTERS AND SPECIAL SYSTEMS ENCLOSURES: 1/4 INCH IDENTIFY EQUIPMENT DESIGNATION; 1/8 INCH IDENTIFY VOLTAGE RATING AND SOURCE.
- B. INDIVIDUAL CIRCUIT BREAKERS, SWITCHES, AND MOTOR STARTERS IN PANELBOARDS, SWITCHBOARDS, AND MOTOR CONTROL CENTERS: 3/16 INCH IDENTIFY CIRCUIT AND LOAD SERVED, INCLUDING LOCATION OF EQUIPMENT.
- C. ENCLOSED CIRCUIT BREAKERS, ENCLOSED SWITCHES, AND MOTOR STARTERS: 3/16 INCH IDENTIFY LOAD SERVED.
- 3.3 WARNING SIGNS
- A. WARNING SIGNS SHALL BE PERMANENTLY MOUNTED WITH CADMIUM PLATED STEEL SCREWS OR NICKEL-PLATED BRASS BOLTS.
 - B. WARNING SIGNS TO READ "DANGER – HIGH VOLTAGE", WITH LETTERS 1-1/2 INCH HIGH, 3/16 INCH STROKE MINIMUM.
 - C. PROVIDE WARNING SIGN ON ALL DOORS OR IMMEDIATELY NEXT TO DOOR FOR EQUIPMENT ROOMS, ENCLOSURES OR CLOSETS CONTAINING EQUIPMENT ENERGIZED ABOVE 150 VOLTS TO GROUND AS PER CEC, AND/OR AS DIRECTED BY THE ARCHITECT. FOR INTERIOR FINISH SPACES AND INTERIOR DOORS, SIGNAGE SHALL BE COORDINATED AND APPROVED WITH THE ARCHITECT IN ADVANCE OF INSTALLATION.

END OF SECTION 16141

SECTION 16160 – PANELBOARDS

- PART 1 – GENERAL**
- 1.1 DESCRIPTION
- A. THIS SECTION SPECIFIES THE FURNISHING, INSTALLATION AND CONNECTION OF PANELBOARDS.
- 1.2 RELATED WORK
- A. PAINTING SECTION: IDENTIFICATION AND PAINTING OF PANELBOARDS.
 - B. SECTION 16050, BASIC MATERIALS AND METHODS.
 - C. SECTION 16110, RACEWAYS.
 - D. SECTION 16120, POWER WIRE, CABLES AND CONDUCTORS (600 VOLTS AND BELOW): CABLES AND WIRING.
 - E. SECTION 16450, GROUNDING: REQUIREMENTS FOR PERSONNEL SAFETY AND TO PROVIDE A LOW IMPEDANCE PATH FOR POSSIBLE GROUND FAULT CURRENTS.
- 1.3 APPLICABLE PUBLICATIONS
- A. PUBLICATIONS LISTED BELOW (INCLUDING AMENDMENTS, ADDENDA, REVISIONS, SUPPLEMENTS AND ERRATA) FORM A PART OF THIS SPECIFICATION TO THE EXTENT REFERENCED. PUBLICATIONS ARE REFERENCED IN THE TEXT BY THE BASIC DESIGNATION ONLY.
- B. UNDERWRITERS LABORATORIES, INC. (UL):
1. NO. 50–1995 ENCLOSURES FOR ELECTRICAL EQUIPMENT
 2. NO. 67–1993 PANELBOARDS
 3. NO. 489–1991 MOLDED CASE CIRCUIT BREAKERS AND CIRCUIT BREAKER ENCLOSURES
- C. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):
1. NO. 70–2004 CALIFORNIA ELECTRICAL CODE (CEC)
- D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA):
1. NO. PB–1–2002 PANELBOARDS.
 2. NO. AB–3–1996 MOLDED CASE CIRCUIT BREAKERS AND THEIR APPLICATION.
- PART 2 – PRODUCTS**
- 2.1 PANELBOARDS
- A. PANELBOARDS SHALL BE IN ACCORDANCE WITH UL, NEMA, NEC, CEC AND AS SHOWN ON THE DRAWINGS. APPROVED MANUFACTURERS ARE CUTLER HAMMER, SQUARE D, SEIMENS, GENERAL ELECTRIC.
- B. PANELBOARDS SHALL BE STANDARD MANUFACTURED PRODUCTS. ALL COMPONENTS OF THE PANELBOARDS SHALL BE THE PRODUCT AND ASSEMBLY OF THE SAME MANUFACTURER. ALL SIMILAR UNITS OF ALL PANELBOARDS TO BE OF THE SAME MANUFACTURER.
- C. ALL PANELBOARDS SHALL BE DEAD FRONT SAFETY TYPE. ARRANGE SECTIONS FOR EASY REMOVAL WITHOUT DISTURBING OTHER SECTIONS.
- D. ALL PANELBOARDS SHALL BE COMPLETELY FACTORY ASSEMBLED WITH MOLDED CASE CIRCUIT BREAKERS. ALL FACTORY WIRING SHALL BE CHECKED FOR CORRECT TIGHTNESS AND VISUALLY INSPECTED TO INSURE THAT BUSSING AND TERMINATIONS HAVE NOT BECOME LOOSE IN TRANSIT TO JOB SITE.
- E. PANELBOARDS SHALL HAVE MAIN BREAKER OR MAIN LUGS, BUS SIZE, VOLTAGE, PHASE, TOP OR BOTTOM FEED, AND FLUSH OR SURFACE MOUNTING AS SCHEDULED ON THE DRAWINGS. REFER TO SINGLE LINE DIAGRAM AND PANEL SCHEDULES ON DRAWINGS. TERMINALS SHALL BE MINIMUM 75 DEGREE RATED. BACK FEED MAIN CIRCUIT BREAKERS ARE NOT ALLOWED. MAIN CIRCUIT BREAKERS SHALL BE VERTICALLY MOUNTED.
- F. PANELBOARDS SHALL HAVE THE FOLLOWING FEATURES:
1. NONREDUCED SIZE COPPER BUS BARS, AND CONNECTION STRAPS BOLTED TOGETHER AND RIGIDLY SUPPORTED ON MOLDED INSULATORS. BUS BAR TAPS FOR PANELS WITH SINGLE POLE BRANCHES SHALL BE ARRANGED FOR SEQUENCE PHASING OF BRANCH CIRCUIT DEVICES.
 2. FULL SIZE NEUTRAL BAR, MOUNTED ON INSULATED SUPPORTS.
 3. GROUND BAR AND ISOLATION GROUND BAR (WHERE CALLED FOR IN PANEL SCHEDULE) WITH SUFFICIENT TERMINALS FOR ALL GROUNDING WIRES. BUSES BRACED FOR THE AVAILABLE SHORT CIRCUIT CURRENT.

4. ALL BREAKERS AND PHASE BUS CONNECTIONS SHALL BE ARRANGED SO THAT IT WILL BE POSSIBLE TO SUBSTITUTE A 2-POLE BREAKER FOR TWO SINGLE POLE BREAKERS, AND A 3-POLE BREAKER FOR THREE SINGLE POLE BREAKERS, WHEN TRIP IS 30 AMPS OR LESS AND FRAME SIZE IS 100 AMPERES OR LESS, WITHOUT HAVING TO DRILL AND TAP THE MAIN BUS BARS AT BUS STRAPS. WHERE USED FOR HEATING AND AIR CONDITIONING, AND REFRIGERATION EQUIPMENT, USE ONLY HACR TYPE U.L. LISTED CIRCUIT BREAKERS.
 5. DESIGN INTERIOR SO THAT PROTECTIVE DEVICES CAN BE REPLACED WITHOUT REMOVING ADJACENT UNITS, MAIN BUS CONNECTORS, AND WITHOUT DRILLING OR TAPPING.
 6. WHERE DESIGNATED ON PANEL SCHEDULE AS "SPACE", INCLUDE ALL NECESSARY BUSSING, DEVICE SUPPORT AND CONNECTIONS. PROVIDE BLANK COVER FOR EACH SPACE.
 7. SERIES RATED PANELBOARDS ARE NOT PERMITTED.
 8. LABEL ALL PANELS IN ACCORDANCE WITH SECTION 16141, EQUIPMENT LABELS AND NAMEPLATES AND WARNING SIGNS.
- C. PANELBOARDS SERVING AS BUILDING MAINS SHALL BE "SERVICE ENTRANCE RATED" AND UL LISTED AS "SERVICE EQUIPMENT".
- 2.2 CABINETS AND TRIMS
- A. CABINETS:
1. PROVIDE GALVANIZED STEEL CABINETS TO HOUSE PANELBOARDS. CABINETS FOR OUTDOOR PANELS SHALL BE FACTORY PRIMED AND SUITABLY TREATED WITH A CORROSION-RESISTING PAINT FINISH MEETING UL STANDARD FOR OUTDOOR APPLICATIONS.
 2. CABINET ENCLOSURE SHALL NOT HAVE VENTILATING OPENINGS.
 3. CABINETS FOR PANELBOARDS MAY BE OF ONE PIECE FORMED STEEL OR OF FORMED SHEET STEEL WITH END AND SIDE PANELS WELDED, RIVETED, OR BOLTED AS REQUIRED.
 4. PROVIDE NECESSARY HARDWARE FOR "IN" AND "OUT" ADJUSTMENT OF PANEL INTERIOR.
 5. CABINETS FOR TWO SECTION PANELBOARDS SHALL BE ARRANGED SIDE BY SIDE, AND SHALL BE THE SAME HEIGHT. FLUSH MOUNTED CABINETS SHOULD BE 1-1/2 INCHES APART AND COULDED BY CONDUIT NIPPLE, IF NECESSARY.
 6. GUTTER SIZE IN PANEL BOXES, ON ALL SIDES, SHALL BE IN ACCORDANCE WITH THE CEC. PENETRATIONS THROUGH GUTTER TO LIVE AREA OF THE PANELBOARD SHALL INCORPORATE APPROVED NON-METALLIC-GROMMET TYPE OF INSULATION TO PROTECT WIRE PASSING THROUGH.
- B. TRIMS:
1. FABRICATE TRIM OF SHEET STEEL CONSISTING OF FRAME WITH DOOR ATTACHED BY CONCEALED HINGES. PROVIDE FLUSH OR SURFACE TRIM AS SHOWN ON THE DRAWINGS.
 2. FLUSH TRIMS SHALL OVERLAP THE BOX BY AT LEAST 3/4-INCH ALL AROUND.
 3. SURFACE TRIM SHALL HAVE THE SAME WIDTH AND HEIGHT AS THE BOX.
 4. FLUSH OR SURFACE TRIMS SHALL NOT HAVE VENTILATING OPENINGS.
 5. SECURE TRIMS TO BACK BOXES BY INDICATING TRIM CLAMPS.
 6. PROVIDE A WELDED ANGLE ON REAR OF TRIM TO SUPPORT AND ALIGN TRIM TO CABINET.
 7. PROVIDE SEPARATE TRIMS FOR EACH SECTION OF MULTIPLE SECTION PANELBOARDS. TRIMS AND DOORS OF SECTIONS SHALL BE OF THE SAME HEIGHT.
- C. DOORS:
1. PROVIDE DOORS WITH FLUSH TYPE LATCH AND MANUFACTURER'S STANDARD LOCK. DOORS OVER 48 INCHES IN HEIGHT SHALL HAVE A VAULT HANDLE AND A THREE-POINT CATCH, ARRANGED TO FASTEN DOOR AT TOP, BOTTOM, AND CENTER.
 2. IN MAKING SWITCHING DEVICES ACCESSIBLE, DOORS SHALL NOT UNCOVER ANY LIVE PARTS.
 3. PROVIDE CONCEALED HINGES WELDED TO THE DOORS AND TRIMS.
 4. FOR LIGHTING OR POWER CONTACTORS INCORPORATED IN PANELBOARDS, PROVIDE SEPARATE DOORS FOR THE CONTACTORS.
 5. PROVIDE KEYED ALIKE SYSTEM FOR ALL PANELBOARDS.
 6. PROVIDE A DIRECTORY CARD, METAL HOLDER, AND TRANSPARENT COVER. PERMANENTLY MOUNT HOLDERS ON INSIDE OF DOORS.
- D. PAINTING:
1. THOROUGHLY CLEAN AND PAINT TRIMS AND DOORS AT THE FACTORY WITH PRIMER AND MANUFACTURER'S STANDARD FINISH.
- 2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS
- A. BREAKERS SHALL BE UL LISTED AND LABELED, IN ACCORDANCE WITH THE CEC, AS SHOWN ON THE DRAWINGS, AND AS SPECIFIED.
- B. CIRCUIT BREAKERS IN PANELBOARDS SHALL BE BOLT ON TYPE ON PHASE BUS BAR OR BRANCH CIRCUIT BAR.
1. MOLDED CASE CIRCUIT BREAKERS FOR LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS SHALL HAVE MINIMUM INTERRUPTING RATING AS INDICATED.
 2. MOLDED CASE CIRCUIT BREAKERS SHALL HAVE AUTOMATIC, TRIP FREE, NON-ADJUSTABLE, INVERSE TIME, AND INSTANTANEOUS MAGNETIC TRIPS FOR 100 AMPERE FRAME OR LESS. MAGNETIC TRIP SHALL BE ADJUSTABLE FROM 3 TIMES TO 10 TIMES FOR BREAKERS WITH 600 AMPERE FRAMES AND HIGHER. FACTORY SETTING SHALL BE HI, UNLESS OTHERWISE NOTED.
- C. BREAKER FEATURES SHALL BE AS FOLLOWS:
1. INTEGRAL HOUSING OF MOLDED INSULATING MATERIAL.
 2. SILVER ALLOY CONTACTS.
 3. ARC QUENCHERS AND PHASE BARRIERS FOR EACH POLE.
 4. QUICK-MAKE, QUICK-BREAK, OPERATING MECHANISMS.
 5. A TRIP ELEMENT FOR EACH POLE, THERMAL MAGNETIC TYPE WITH LONG TIME DELAY AND INSTANTANEOUS CHARACTERISTICS, A COMMON TRIP BAR FOR ALL POLES AND A SINGLE OPERATOR.
 6. ELECTRICALLY AND MECHANICALLY TRIP FREE.
 7. AN OPERATING HANDLE WHICH INDICATES ON, TRIPPED, AND OFF POSITIONS.
- A. LINE CONNECTIONS SHALL BE BOLTED.
- B. INTERRUPTING RATING SHALL NOT BE LESS THAN THE MAXIMUM SHORT CIRCUIT CURRENT AVAILABLE AT THE LINE TERMINALS AS INDICATED ON THE DRAWINGS, AND AS SHOWN ON THE ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY AS REQUIRED IN SECTION 16051. THE INTERRUPTING RATING SHALL NOT BE LESS THAN THE MINIMUM IDENTIFIED REQUIREMENT.
8. AN OVERLOAD ON ONE POLE OF A MULTIPOLE BREAKER SHALL AUTOMATICALLY CAUSE ALL THE POLES OF THE BREAKER TO OPEN.

PART 3 – EXECUTION

- 3.1 INSTALLATION
- A. INSTALLATION SHALL BE IN ACCORDANCE WITH CEC, AS SHOWN ON THE DRAWINGS, AND AS SPECIFIED.
- B. LOCATE PANELBOARDS SO THAT THE PRESENT AND FUTURE CONDUITS CAN BE CONVENIENTLY CONNECTED. COORDINATE THE SIZES AND LAYOUT OF CABINETS WITHIN THE DESIGNATED SPACES. ALL EQUIPMENT MUST BE DIMENSIONED IN ORDER TO PHYSICALLY FIT IN THE SPACES PROVIDED AND TO COMPLY WITH ALL CODE REQUIRED CLEARANCES.
- C. INSTALL A TYPED SCHEDULE OF CIRCUITS IN EACH PANELBOARD. INCLUDE THE ROOM NUMBERS (AS FINALLY DESCRIBED BY THE OWNER) AND ITEMS SERVED ON THE CARDS. OBTAIN FINAL ROOM NUMBERS FROM ARCHITECT PRIOR TO CREATING SCHEDULE.
- D. MOUNT THE PANELBOARD SO THAT MAXIMUM HEIGHT OF THE TOP CIRCUIT BREAKER ABOVE FINISHED FLOOR SHALL NOT EXCEED 78 INCHES.
- E. FOR PANELBOARDS LOCATED IN AREAS ACCESSIBLE TO THE PUBLIC, PAINT THE EXPOSED SURFACES OF THE TRIMS, DOORS, AND BOXES WITH FINISHES TO MATCH SURROUNDING SURFACES AFTER THE PANELBOARDS HAVE BEEN INSTALLED.
- F. CIRCUIT NUMBERS SHALL CORRESPOND TO THE APPROVED PANEL SCHEDULE. PROVIDE AS-BUILT DRAWINGS SHOWING THE ACTUAL CIRCUIT NUMBERS BEING USED FOR EACH DEVICE ON EACH BRANCH CIRCUIT IF CHANGES ARE REQUIRED.
- G. VERIFY DEPTH OF ALL FLUSHMOUNTED ENCLOSURES IN WALLS TO BE CERTAIN WALL DEPTH WILL ACCOMMODATE PANEL DEPTH PRIOR TO INSTALLATION.
- H. CONTRACTOR SHALL INCLUDE THE SERVICES OF AN INDEPENDENT TESTING COMPANY TO TEST GFI CIRCUIT BREAKERS IN DISTRIBUTION AND MAIN PANELBOARDS.

END OF SECTION 16160

SECTION 16170 – SWITCHES; DISCONNECT AND SAFETY

PART 1 – GENERAL

1.1 DESCRIPTION

A. PROVIDE ALL LABOR MATERIALS AND EQUIPMENT NECESSARY FOR DISCONNECT AND SAFETY SWITCHES WHERE SHOWN ON THE CONTRACT DRAWINGS AND SPECIFIED HEREIN.

1.2 RELATED WORK

A. WORK OF THIS SECTION SHALL COMPLY WITH THE CONTRACT DOCUMENTS INCLUDING, BUT NOT NECESSARILY LIMITED TO, GENERAL CONDITIONS AND THE GENERAL REQUIREMENTS.

B. SECTION 16141, EQUIPMENT LABELS AND NAMEPLATES AND WARNING SIGNS.

PART 2 – PRODUCTS

- 2.1 GENERAL
- A. APPROVED MANUFACTURERS: CUTLER HAMMER, GENERAL ELECTRIC, ITE-SIEMENS AND SQUARE-D.
- B. DISCONNECT SWITCHES: PROVIDE WITH DEVICES ENABLING THE SWITCH TO BE LOCKED IN THE OPEN OR CLOSED POSITIONS.
- C. MANUAL MOTOR SWITCHES: TUMBLER TYPE RATED 3HP, 240 VOLTS WITH OR WITHOUT OVERLOAD HEATERS AS REQUIRED TO PROTECT EQUIPMENT SERVED.
- D. EXTERNALLY OPERABLE SAFETY SWITCHES: TO HAVE QUICK-MAKE, QUICK-BREAK MECHANISM, CAPABLE OF SWITCHING 10 TIMES SWITCH RATING, WITH COVER INTERLOCK TO PREVENT OPENING WITH SWITCH IN ON POSITION AND DEFEAT MECHANISM FOR MAINTENANCE.
- E. SWITCHES: SHALL BE GENERAL DUTY (GD) FOR 240 VOLT AND BELOW AND HEAVY DUTY (HD) FOR 277/480 VOLT TYPE UNLESS OTHERWISE INDICATED. PROVIDE NEMA 1 ENCLOSURES FOR INTERIOR LOCATIONS AND NEMA 3R ENCLOSURES FOR EXTERIOR OR WET LOCATIONS. PROVIDE WITH NUMBER OF POLES, AMPACITY, VOLTAGE AND HP RATING, FUSIBLE OR NONFUSIBLE AS INDICATED. COPPER BLADES SHALL BE VISIBLE IN OFF POSITION.
- F. FUSIBLE SWITCHES: EQUIP THEM WITH REJECTION CLIPS FOR UL CLASS R FUSES. SWITCHES HAVING A DUAL RATING WHEN USED WITH DUAL ELEMENT FUSES SHALL HAVE A RATING SO INDICATED AND SHALL BE CONFIRMED BY EQUIPMENT VENDOR BEING CONNECTED.
- G. 600 AMPERES OR LESS FUSES: UL CLASS RK1 WITH A MINIMUM INTERRUPTING RATING OF 200,000 AMPERES, BUSSMANN "LOW-PEAK TYPE" OR EQUAL.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. LOCATIONS: INSTALL SWITCHES, DISCONNECTS AND SAFETY WHERE INDICATED ON THE CONTRACT DRAWINGS OR AS REQUIRED BY CEC.

B. FASTENINGS: SECURELY FASTEN SWITCHES TO STRUCTURAL MEMBERS OR UNISTRUT SUPPORT AS DIRECTED BY THE MANUFACTURER.

C. MANUAL MOTOR SWITCHES: INSTALL FLUSH MOUNTED IN FINISHED AREAS.

D. MANUAL MOTOR SWITCHES: INSTALL SURFACE MOUNTED IN EQUIPMENT ROOMS AND NON-FINISHED AREAS. WHERE INSTALLED ABOVE INACCESSIBLE CEILINGS PROVIDE ACCESS PANELS.

E. LABEL ALL DISCONNECT SWITCHES IN ACCORDANCE WITH SECTION 16141, EQUIPMENT LABELS AND NAMEPLATES AND WARNING SIGNS.

F. FUSE: ALL FUSES SHALL BE AS INDICATED ON THE PLAN OR AS REQUIRED BY THE EQUIPMENT. VERIFY FUSE SIZE WITH EQUIPMENT MANUFACTURER REQUIREMENTS, PRIOR TO INSTALLATION. USE CURRENT LIMITING FUSES AS INDICATED ON PLAN. PROVIDE ONE SPARE FUSE CABINET IN EACH ELECTRICAL ROOM WITH ONE COMPLETE SET OF SPARE FUSES FOR ALL SIZES OF MAIN FUSES, SUBPANEL FUSES, HVAC EQUIPMENT FUSES AND FIRE ALARM.

G. TERMINALS SHALL BE MINIMUM 75 DEGREE RATED.

END OF SECTION 16170

SECTION 16402 – UNDERGROUND ELECTRICAL CONSTRUCTION AND SERVICE

GENERAL

- 1.1 DESCRIPTION
- A. THIS SECTION SPECIFIES THE FURNISHING, INSTALLATION AND CONNECTION OF MANHOLES, HANDHOLES AND DUCTS TO FORM A COMPLETE UNDERGROUND RACEWAY SYSTEM AS REQUIRED TO PROVIDE NEW SERVICES TO BUILDING AND REROUTE EXISTING UTILITIES AROUND NEW BUILDING FOOTPRINT.
- B. "DUCT" AND "CONDUIT", AND "RACEWAY" ARE USED INTERCHANGEABLY IN THIS SPECIFICATION AND HAVE THE SAME MEANING. REFER TO SECTION 16110, RACEWAYS FOR APPROVED RACEWAY AND MATERIALS AS WELL AS EXECUTION.
- C. SCOPE OF WORK: FURNISHING, INSTALLATION AND CONNECTION OF MANHOLES, HANDHOLES AND DUCTS TO FORM A COMPLETE UNDERGROUND RACEWAY SYSTEM FOR DISTRIBUTION OF ELECTRICAL AND UTILITY SERVICE ENTRANCE FACILITIES. THIS SPECIFICATION SHALL ALSO PROVIDE GUIDANCE FOR CONSTRUCTION OF THE UTILITY COMPANY UNDERGROUND AND SUBSTRUCTURE REQUIREMENTS. CONTACT SERVING COMPANY DIRECTLY AND OBTAIN CURRENT DETAILED REQUIREMENTS OF INSTALLATION AND ADHERE BY SAME. PROVIDE TRENCHING, CONDUIT, BACKFILL, BOXES AND EQUIPMENT PADS AS APPLICABLE. NOTHING HERE IN SHALL BE CONSTRUED TO BE IN CONFLICT WITH THE REQUIREMENTS OF THE UTILITY COMPANY, WHICH SHALL TAKE PRECEDENCE OVER ANY POSSIBLE CONFLICTING REQUIREMENT.

1.2 RELATED WORK

A. SITEWORK.

B. FLATWORK.

C. LANDSCAPING.

D. SECTION 16050, BASIC MATERIALS AND METHODS.

E. SECTION 16110, RACEWAYS: CONDUITS, FITTINGS AND BOXES FOR RACEWAY SYSTEMS.

F. SECTION 16450, GROUNDING.

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 MANHOLES, HANDHOLES, DUCT MATERIALS, AND HARDWARE. PROPOSED DEVIATIONS FROM DETAILS ON THE DRAWINGS SHALL BE CLEARLY MARKED ON THE SUBMITTALS.

3. IF NECESSARY TO LOCATE MANHOLES OR HANDHOLES AT LOCATIONS OTHER THAN SHOWN ON THE DRAWINGS, SHOW THE PROPOSED LOCATIONS ACCURATELY ON SCALED SITE DRAWINGS.

4. PRECAST MANHOLES AND HANDHOLES: SUBMIT DETAIL DRAWINGS AND DESIGN CALCULATIONS FOR APPROVAL PRIOR TO INSTALLATION.

1.4 APPLICABLE PUBLICATIONS

A. PUBLICATIONS LISTED BELOW (INCLUDING AMENDMENTS, ADDENDA, REVISIONS, SUPPLEMENTS, AND ERRATA) FORM A PART OF THIS SPECIFICATION TO THE EXTENT REFERENCED. PUBLICATIONS ARE REFERENCED IN THE TEXT BY THE BASIC DESIGNATION ONLY.

B. UNDERWRITERS LABORATORIES, INC. (UL):

1. UL 467–1993 GROUNDING AND BONDING EQUIPMENT

2. UL 651–1995 SCHEDULE 40 AND 80 RIGID PVC CONDUIT

3. UL 6–2000 ELECTRICAL RIGID METAL CONDUIT-STEEL

C. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):

1. 70–2002 CALIFORNIA ELECTRICAL CODE (CEC)

D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA):

1. RN 1–1998 POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID STEEL CONDUIT AND INTERMEDIATE METAL CONDUIT

2. TC 2–1998 ELECTRICAL POLYVINYL CHLORIDE (PVC) TUBING AND CONDUIT

3. JO 3–1999 PVC FITTINGS FOR USE WITH RIGID PVC CONDUIT AND TUBING

E. AMERICAN CONCRETE INSTITUTE (ACI):

1. 318–02 BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE

F. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

1. C478–1997STANDARD SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS

2. C478M–1997 STANDARD SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS (METRIC).

3. F512–95(2001) STANDARD SPECIFICATION FOR SMOOTH-WALL POLYVINYL CHLORIDE (PVC) CONDUIT AND FITTINGS FOR UNDERGROUND INSTALLATION

G. UTILITY COMPANY HANDOUT PACKAGE AND CONSTRUCTION REQUIREMENTS FOR UNDERGROUND AND SUBSTRUCTURE INSTALLATION.

PART 2 – PRODUCTS

2.1 MATERIALS

A. CONCRETE: ACI 318, 3000 PSI MINIMUM 28 DAY COMPRESSIVE STRENGTH.

B. REINFORCING STEEL: NUMBER 4 MINIMUM.

C. MANHOLE HARDWARE:

1. FRAMES AND COVERS (TRAFFIC TYPE)

2. SUMP FRAMES AND GRATINGS

3. PULLING IRONS: 7/8 INCH DIAMETER HOT DIPPED GALVANIZED STEEL BAR WITH EXPOSED TRIANGULAR SHAPED OPENING.

4. CABLE SUPPORTS:

A. CABLE STANCHIONS, HOT ROLLED, HEAVY DUTY, HOT DIPPED GALVANIZED "T" SECTION STEEL 2 1/4 INCHES BY 1/2 INCH IN SIZE AND PUNCHED WITH 14 HOLES ON 1 1/2 INCH CENTERS FOR ATTACHING CABLE ARMS.

B. CABLE ARMS, 3/16 INCH GAGE, HOT ROLLED, HOT DIPPED GALVANIZED SHEET STEEL PRESSED TO CHANNEL SHAPE. ARMS SHALL BE APPROXIMATELY 2 1/2 INCHES WIDE AND 14 INCHES LONG.

C. INSULATORS FOR CABLE SUPPORTS, HIGH GLAZED, WET PROCESS PORCELAIN.

- D. SPARES: EQUIP EACH CABLE STANCHION WITH TWO SPARE CABLE ARMS AND SIX SPARE INSULATORS FOR FUTURE USE.
- E. MISCELLANEOUS HARDWARE, HOT DIPPED GALVANIZED STEEL.
- D. HANDHOLE HARDWARE:
1. FRAMES AND COVERS CONFIGURATION AS SHOWN ON THE DRAWINGS.
 2. PULLING IRONS, 7/8 INCH DIAMETER GALVANIZED STEEL BAR WITH EXPOSED TRIANGULAR SHAPED OPENING.
 3. CABLE SUPPORTS ARE NOT REQUIRED.
 4. GROUND ROD SLEEVE: PROVIDE A 3" PVC SLEEVE IN MANHOLE FLOORS SO THAT A DRIVEN GROUND ROD MAY BE INSTALLED.
 5. G. MANHOLES AND HANDHOLES SHALL BE PRECAST UNITS AND BE CONSTRUCTED AS DESCRIBED BELOW. UNITS SHALL COMPLY WITH ASTM C478, C478M.
1. SIZE: PLAN AREA AND CLEAR HEIGHT SHALL BE NOT LESS THAN THAT SHOWN ON THE DRAWINGS.
2. ACCESSORIES, HARDWARE, AND FACILITIES SHALL BE THE SAME AS REQUIRED FOR POURED IN PLACE TYPE.
 3. ASSUME GROUND WATER LEVEL 3 FEET BELOW GROUND SURFACE UNLESS A HIGHER WATER TABLE IS SHOWN IN THE BORING LOGS AND ADJUST DESIGN ACCORDINGLY.
- H. DUCTS:
1. SIZE SHALL BE AS SHOWN ON DRAWINGS.
 2. DUCTS (CONCRETE ENCASED):
 - A. PLASTIC CONDUIT:
 - 1) NEMA TC6 & 8 AND TC9 PLASTIC UTILITIES CONDUIT UL 651 AND 651A SCHEDULE 40 PVC.
 - 2) DUCT SHALL BE SUITABLE FOR USE WITH 90 DEGREE C RATED CONDUCTORS.
 3. DUCTS (DIRECT BURIAL):
 - A. PLASTIC DUCT:
 - 1) NEMA TC2 AND TC3, EPC-40, TYPE II.
 - 2) UL 651 AND 651A, SCHEDULE 40 SCHEDULE 80 PVC.
 - 3) DUCT SHALL BE SUITABLE FOR USE WITH 75 DEGREE C RATED CONDUCTORS.
 - B. RIGID METAL CONDUIT, PVC-COATED: UL6 AND NEMA RN1 GALVANIZED RIGID STEEL, THREADED TYPE, COATED WITH PVC SHEATH BONDED TO THE GALVANIZED EXTERIOR SURFACE, NOMINAL 0.040 INCH THICK.
 - I. GROUND RODS: PER SECTION 16450, GROUNDING.
 - J. GROUND WIRE: STRANDED BARE COPPER NO. 6 AWG MINIMUM.
 - K. CONDUIT SPACERS: PREFABRICATED PLASTIC.
 - L. WARNING TAPE: STANDARD 4-MIL POLYETHYLENE 3 INCH WIDE TAPE, DETECTABLE TYPE, RED WITH BLACK LETTERS, IMPRINTED WITH "CAUTION BURIED ELECTRIC CABLE BELOW".
 - M. PULL ROPE: PLASTIC WITH 200 POUND MINIMUM TENSILE STRENGTH.

PART 3 – EXECUTION

3.1 TRENCHING

- A. REFER TO EARTHWORK SECTION OF SPECIFICATION FOR TRENCHING BACK-FILLING, AND COMPACTION REQUIREMENTS.
- B. WORK WITH EXTREME CARE NEAR EXISTING DUCTS, CONDUITS, CABLES, AND OTHER UTILITIES TO AVOID DAMAGING THEM.
- C. CUT THE TRENCHES NEATLY AND UNIFORMLY FOR UTILITY COMPANY TRENCHES. NOTIFY FOR INSPECTIONS BY UTILITY COMPANY A MINIMUM OF 48 HOURS IN ADVANCE.
- D. CONDUITS TO BE INSTALLED UNDER EXISTING PAVED AREAS, ROADS, AND RAILROAD TRACKS WHICH ARE NOT TO BE DISTURBED SHALL BE PROTECTED INTO PLACE. CONDUITS SHALL BE MINIMUM 36" COVER.
- E. TRENCH PREPARATION: A 4-INCH SAND BEDDING IS REQUIRED IF TRENCH BOTTOM IS NOT ROCK FREE. A 4-INCH SAND COVERING OVER THE CABLE IS REQUIRED IF THE NATIVE BACKFILL IS NOT ROCK FREE. BACKFILL AND COVERING SHOULD BE CITY, COUNTY, STATE AND UTILITY COMPANY REQUIREMENTS. THE SERVING UTILITY COMPANY MAY REQUIRE 100% SAND BACKFILL. ALL BACKFILL REQUIREMENTS SHALL ALSO MEET OR EXCEED THOSE SET FORTH IN THE EARTHWORK OR CIVIL SECTION OF THIS SPECIFICATION.
- F. EXCAVATION: PROVIDE 6" GRAVEL IN BOTTOM OF EXCAVATED HOLES FOR SUBSURFACE TRANSFORMERS AND ALL CONCRETE BOXES. SPARE GRAVEL SHALL BE AVAILABLE FOR FINAL ADJUSTMENT. THE CONTRACTOR IS RESPONSIBLE FOR FINAL GRADE LEVEL OF ENCLOSURES AND BOXES. NON-COMFORMANCE WILL BE CORRECTED BY ELECTRICAL CONTRACTOR AT HIS EXPENSE.
- G. CONDUIT ROUTING: SHARP TURNS, BENDS, OR OTHER IRREGULARITIES IN THE CONDUIT MUST BE AVOIDED. MINIMUM RADIUS BENDS SHALL BE AS REQUIRED BY THE SERVING UTILITY COMPANY. EVERY EFFORT SHOULD BE MADE TO OBTAIN A STRAIGHT WATER TIGHT CONDUIT LINE. THE END OF ALL SPARE CONDUITS MUST BE CAPPED. THE UTILITY COMPANY INSPECTOR MUST APPROVE DEVIATION FROM LAYOUT.
- H. PERFORMANCE: ALL WORK MUST CONFORM TO THE UTILITY COMPANY "HANDOUT PACKAGE" AND SPECIFICATION 59 AND/OR 99. COPIES ARE AVAILABLE FROM THE UTILITY COMPANY UPON REQUEST.
- I. JOINT TRENCHING: MAINTAIN ALL REQUIRED DEPTHS, CLEARANCE AND SEPARATIONS AS REQUIRED BY CODE, ORDINANCE OR UTILITY COMPANY POLICIES. COORDINATE WITH OTHER UTILITIES TO CONFIRM REQUIREMENTS.

3.2 OTHER PADMOUNTED EQUIPMENT

A. PROVIDE ADEQUATELY SIZED AND REINFORCED CONCRETE PADS WITH OPENINGS FOR CONDUIT(S) AS NECESSARY BY THE UTILITY COMPANY AND OR THE EQUIPMENT MANUFACTURER.

B. A GROUNDING SYSTEM SHALL BE INSTALLED AT EACH PADMOUNTED PIECE OF EQUIPMENT INCLUDING, BUT NOT LIMITED TO, A GROUND ROD, GROUNDING CONDUCTOR, UFER, AND GROUND GRID (IF CALLED FOR).

C. PADMOUNTED EQUIPMENT SHALL BE BOLTED TO CONCRETE PAD WITH MINIMUM 5/8" X 7 1/2" ANCHOR BOLTS, ONE IN EACH OF 4 CORNERS OF EACH SECTION OF PADMOUNTED EQUIPMENT.

END OF SECTION 16402

SECTION 16426 – SERVICE AND DISTRIBUTION EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. PROVIDE ALL LABOR MATERIALS AND EQUIPMENT NECESSARY FOR THE SERVICE EQUIPMENT WHERE SHOWN ON THE CONTRACT DRAWINGS AND SPECIFIED HEREIN.

1.2 RELATED WORK

A. WORK OF THIS SECTION SHALL COMPLY WITH THE CONTRACT DOCUMENTS INCLUDING, BUT NOT NECESSARILY LIMITED TO, GENERAL CONDITIONS AND THE GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

A. CONFORM TO APPLICABLE CODES AND NEMA, ANSI AND IEEE STANDARDS.

1.4 SUBMITTALS

A. CONFORM TO APPLICABLE PROVISIONS OF SECTION 01330 OF DIVISION 1 – GENERAL REQUIREMENTS AND OF SECTION 16050, BASIC MATERIALS AND METHODS.

B. SHOP DRAWINGS SHALL SHOW AND CONTAIN THE FOLLOWING INFORMATION:

1. PLANS SHOWING TOP AND BOTTOM OF EQUIPMENT.

2. FRONT, REAR AND SIDE ELEVATIONS OF EQUIPMENT.

3. SCHEMATIC WIRING DIAGRAMS SHOWING THE FOLLOWING:

- A. ONE-LINE DIAGRAM WITH EACH CIRCUIT NUMBERED.
- B. SCHEDULE SHOWING CIRCUIT NUMBER, DESCRIPTION AND RATING OF PROTECTIVE DEVICE(S).

C. COMPLETE SHORT CIRCUIT WITH STABILITY OF BUS.

PART 2 – PRODUCTS

2.1 MATERIALS

A. MEETED EQUIPMENT SHALL BE U.L. LISTED. CONSTRUCTION SHALL BE NEMA CLASS II WITH LINE AND LOAD AND MAIN BUS CONNECTIONS ACCESSIBLE FROM THE FRONT. OVERCURRENT PROTECTIVE DEVICES SHALL BE GROUPED IN CONVERTIBLE TYPE CONSTRUCTION. EQUIPMENT SHALL INCLUDE ALL PROTECTIVE DEVICES AND OTHER EQUIPMENT INDICATED ON THE CONTRACT DRAWINGS. BUS SHALL BE COPPER WITH PLATED JOINTS, OR TIN PLATED ALUMINUM. BUS BARS SHALL BE MOUNTED ON SUPPORTS OF HIGH IMPACT-RESISTANT, NON-TRACKING INSULATING MATERIAL, AND BRACED TO WITHSTAND THE MAXIMUM AVAILABLE FAULT CURRENT AS INDICATED ON THE CONTRACT DRAWINGS. OTHER RATINGS SHALL BE AS INDICATED ON THE CONTRACT DRAWINGS. SERIES-CONNECTED OR "INTEGRATED" EQUIPMENT SHORT CIRCUIT RATINGS SHALL NOT BE APPLIED IN LIEU OF, OR TO COMPLY WITH, SHORT CIRCUIT AND INTERRUPTING CAPACITY RATINGS INDICATED ON THE DRAWINGS, UNLESS SPECIFICALLY APPROVED BY THE ENGINEER. EQUIPMENT SHALL BE AS MANUFACTURED BY CUTLER HAMMER OR EQUAL.

ACCESSIBILITY IMPROVEMENTS

ROLLING HILLS APARTMENTS

TEMPLETON, CA

CLIENT JOB # ARCHITECT JOB #

0708B

PROJECT MANAGER JT

DRAWN BY DM

DATES FIRST SUBMITTAL 5/28/10