

16000 ELECTRICAL**Clearances**

- 1) Working clearances around electrical equipment shall be maintained per current applicable California Electrical Code (CEC) requirements, these requirements shall be considered a minimum and will be strictly enforced.
- 2) Dedicated space above and around electrical equipment shall be maintained per current applicable CEC requirements, these requirements shall be considered a minimum and will be strictly enforced.
- 3) Access and entrance to electrical equipment shall be maintained per current applicable CEC requirements, these requirements shall be considered a minimum and will be strictly enforced.

Equipment

- 1) Manufacturers: Square D, GE.
- 2) The electrical equipment shall be coordinated as a system with circuit breaker and fuse timing curves to prevent blackouts or brownouts within the electrical system by a coordination study approved by UCSB prior to final acceptance of equipment and installation. After installation, the system shall be tested and calibrated to operate as a properly coordinated system by the manufacturers approved testing representative. Written copy of the testing, settings and timing curve charts shall be provided to UCSB before final acceptance of the equipment.
- 3) Main service switchboard shall be installed indoors; outdoor installation shall not be allowed.
- 4) Provide electrical revenue quality meter per UCSB requirements. Installation shall be in accordance with UCSB installation requirements per Jim Dewey, Energy Manager, UCSB Physical Facilities.
- 5) Panelboards shall be required for branch circuit breakers; load centers shall not be allowed.
- 6) All circuit breakers shall be of the bolt-in type; plug-in type circuit breakers shall not be allowed. Exception: Square D I-Line.
- 7) All motor control devices (e.g., starters, contactors, relays, circuit breakers) to be of NEMA design standard; IEC design standard not allowed.
- 8) All switchboard, panelboard, motor control center buss bars and transformer windings shall be of copper construction; aluminum shall not be allowed.

- 9) Disconnect switches shall be Heavy Duty type only.
- 10) Switchboards, panelboards and motor control centers shall not be used for junction or pull boxes; only the conductors terminated within a switchboard, panelboard or motor control center shall be allowed; conductors may not route through a switchboard, panelboard or motor control center without purpose of termination within the cabinet. Exception: motor control conductors.
- 11) Switchboards, panelboards and motor control centers shall have an individual, common ground bar for termination of all grounds entering the enclosure; all grounds entering the enclosure shall be terminated on the ground bar. Ground bar shall have sufficient size and capacity for termination of the largest grounding conductors. Ground bar shall have sufficient size and capacity for termination of a minimum of one conductor per circuit breaker pole in panelboards. Ground bar shall have sufficient size and capacity for termination of a minimum of one conductor per circuit in switchboards and motor control centers. Ground bars and lugs shall be attached to the cabinet with machine screws, TEK or sheetmetal screws shall not be allowed.

Temporary Services

- 1) Temporary services shall be installed per the CEC requirements.
- 2) All conductors for temporary wiring shall be installed in conduit or shall be of hard usage flexible cord. Exception: Overhead service drops when run from point-of attachment to point-of-attachment, in free-air per the CEC, Articles 230 and 321.
- 3) Provide electrical revenue quality meter for temporary power service.

Conduit

1. Nonmetallic Sheathed Cable (NM, NMC, NMS), Underground Feeder and Branch-Circuit Cable (UF), Service Entrance Cable (SE, USE), Metal-Clad Cable (MC), Armored Cable (AC), Mineral Insulated Cable, Metal Sheathed Cable (MI), and Flat Cable (FCC) shall not be allowed. Exception: With special permission from UCSB for unique applications, on an individual design basis.
2. Conductors shall be installed in conduit. Exception: With special permission from UCSB for unique applications, on an individual design basis.
3. Minimum size of conduit shall be 3/4". Exception: Switchlegs, control systems, alarm systems.
4. Branch circuit conduit shall not contain more than 4 current carrying conductors.
5. All conduits and raceways shall contain a green insulated copper equipment grounding conductor routed with all current carrying conductors, landed and bonded

to the conductive enclosure and grounding system at each end. Exception: Service and/or separately derived system connections per CEC.

6. Non Metallic Flexible Conduit (ENT) shall not be allowed.
7. Rigid Nonmetallic Conduit (PVC) shall not be allowed inside buildings or walls.
8. All conduit stubs out of concrete shall be rigid steel conduit extending within a minimum of 2" within the concrete, wrapped with 2 layers of 1/2 lapped 10 mil tape or 1 layer of 1/2 lapped 20 mil tape; PVC stub outs shall not be allowed.
9. Flexible Metal Conduit shall be of steel construction; aluminum or plastic is not allowed.
10. Flexible Metal Conduit shall not be allowed within concealed wall spaces. Exception: Fished-in Flexible Metal Conduit in remodel installations.
11. Flexible Metal Conduit shall generally be limited to use where movement, vibration or removal of equipment is a factor. Flexible Metal Conduit may be installed for lighting fixtures in accessible areas.
12. Flexible Metal Conduit shall be limited to individual lengths of a minimum of 3 feet and a maximum of 6 feet. Exception: Fished-in Flexible Metal Conduit in remodel installations may be more than 6 feet when properly strapped per CEC.
13. Flexible Metal Conduit shall be limited to a total of 180 degrees of bend per individual run of conduit, with the minimum bend radius per CEC. Exception: Fished-in Flexible Metal Conduit in remodel installations shall be limited to a maximum of 360 degrees.
14. Flexible Metal Conduit shall terminate at the end of a conduit run (shall not be allowed in mid-run of a conduit).
15. Restrictions for installation of Flexible Metal Conduit shall also apply for all other types of flexible conduit as a minimum requirement.
16. Conductors within concealed interior wall spaces shall be installed in Electrical Metallic Conduit (EMT) or Rigid Metal Conduit. Exception: With special permission from UCSB for unique applications, on an individual design basis.
17. Electrical Metallic Tubing (EMT) shall not be installed within concrete pours or block walls.
18. Where subject to mechanical damage, conductors shall be installed in Rigid Metal Conduit.

19. Intermediate Metal Conduit (IMC) conduit shall not be allowed.
20. Conduits shall not be overfilled with conductors per CEC.

Boxes

- 1) Boxes shall not be overfilled with conductors per CEC.
- 2) All branch circuit boxes shall be grounded with a ground pigtail and a #10-32 green machine screw.
- 3) All boxes shall be identified inside the back wall and all blank covers shall be identified on the outside surface with proper panel and circuit identification with permanent marker or other permanent means.
- 4) Non-metallic boxes shall not be allowed. Exception: Where deemed applicable for corrosive environments and with special permission from UCSB for unique applications, on an individual design basis.

Raceways

- 1) Non-metallic surface raceways shall not be allowed inside occupied building areas.
- 2) Underfloor raceways shall not be allowed (such as Walker Duct).
- 3) Underground or in-slab conduits shall be run straight with building/column lines.

Conductors

- 1) Conductors shall be de-rated for conduit fill per CEC.
- 2) All conductors shall be copper only; aluminum is not allowed.
- 3) All conductors of #14 gauge and larger shall be stranded (copper).
- 4) All electrical systems above 30 volts shall be installed in conduit with drawn-in conductors, type MC cable or other cable assemblies are not allowed. Exception: With special permission from UCSB for unique applications, on an individual design basis.
- 5) Color code for 120/208 volt conductors shall be: Black - A phase / Red - B phase / Blue - C phase / White - neutral.
- 6) Color code for 277/480 volt conductors shall be: Brown - A phase / Orange - B phase / Yellow - C phase / White - neutral.

- 7) Flexible cords and cables (e.g. type SO, SJ) shall be installed per the CEC and terminate at a minimum of one end by attachment plug and receptacle.

Identification

- 1) All outlets and disconnect switches shall be identified by permanent label or engraved cover plate with proper panel or feed source and circuit identification.
- 2) Panelboard circuits shall be identified at the panelboard with proper detailed circuit information regarding what items are being fed.
- 3) All switchboards, panelboards, motor control centers, fuse holders, circuit breakers and motor control devices shall be identified by permanent label or engraved cover plate with proper feed source and circuit identification.

Drawings

- 1) A complete set of accurate "as built" drawings of the complete electrical installation shall be provided. The drawings shall be professionally drafted. Hand drawn/marked up drawings shall not be acceptable.

Medium Voltage

- 1) It shall be noted that UCSB is its own power utility entity and that the electrical 15 KV (12.47 KV nominal) distribution and service installation shall be in accordance with UCSB installation requirements per David McHale, Senior Electrical Engineer, UCSB Physical Facilities.