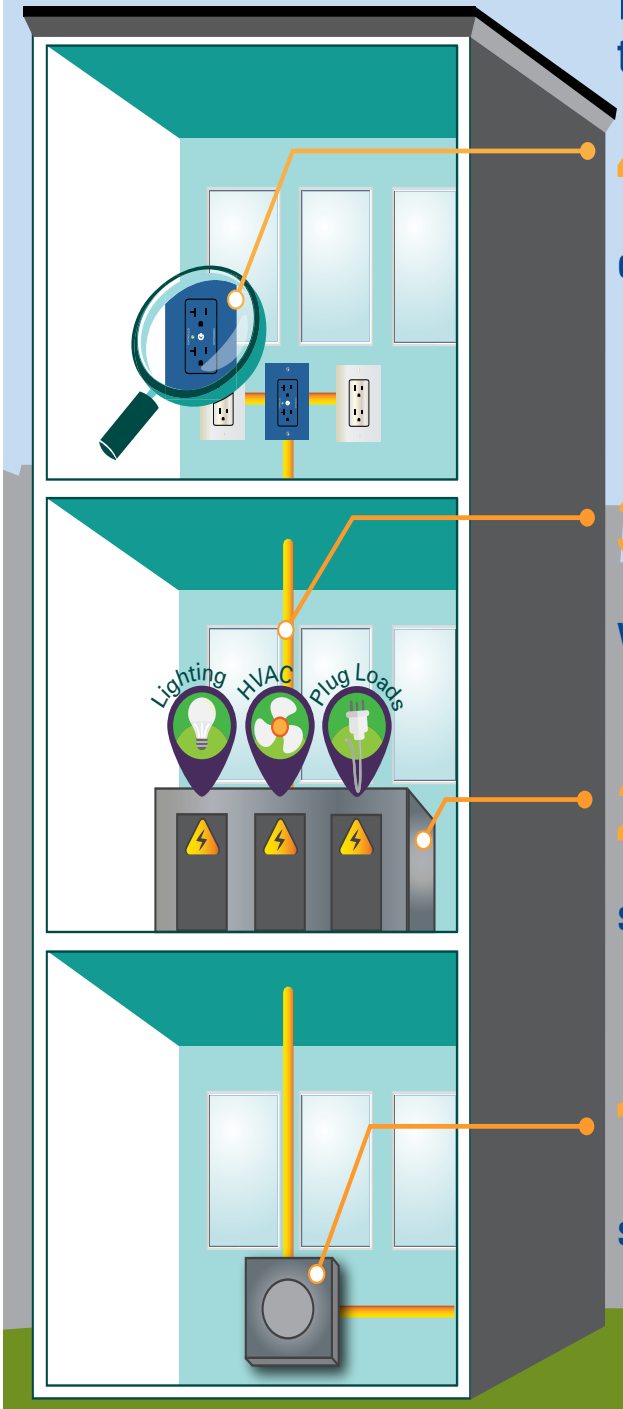
Nonresidential

Electrical Power Distribution

Watt's Happening Here?

Electricity's Trip From the Ground Up



4 ***When the electricity arrives at its final destination, it may need to be controlled.***

Circuit Controls

§130.5(d) In office areas, lobbies, conference rooms, kitchens in office spaces, and copy rooms, one controlled outlet must be within a 6-foot radius of any number of uncontrolled outlets.

3 ***As electricity flows through the building's wires, voltage drops.***

Voltage Drop

§130.5(c) Size conductors so that voltage drop does not exceed 5%.

2 ***Once in the building, it must make a choice on where to go (e.g., HVAC, lighting, plug loads).***

Separation of Load

§130.5(b) Separate electric load so Building Owner can meter specific uses.

1 ***The trip begins… electricity arrives at a building and knocks to get in.***

Service Metering

§130.5(a) Meter to allow Building Owner to monitor building electricity usage.

What is Electrical Power Distribution?

Electrical power distribution (EPD) systems encompass electrical systems and equipment not specific to lighting. All requirements in Section 130.5 of the 2016 Building Energy Efficiency Standards (Energy Standards) are mandatory.

These requirements apply to all new construction, additions, and alterations for nonresidential, high-rise residential and hotel/motel buildings.

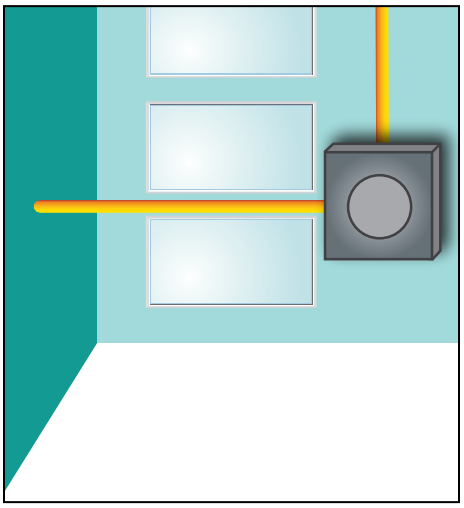
Relevant Code Sections

2016 California Building Energy Efficiency Standards, Title 24, Part 6:

- Section 130.5 – Electrical Power Distribution Systems
- Section 141.0(b)2P – Additions and Alterations Requirements

Relevant Compliance Forms

- NRCC-ELC-01-E: Electrical Power Distribution
- NRCI-ELC-01-E: Electrical Power Distribution
- NRCI-LTI-02-E EMCS: Lighting Control System (if used to control 120-Volt receptacles)



The trip begins…
electricity arrives at a building and knocks to get in.

Mandatory Requirements

Electrical Service Metering Section 130.5(a)

All newly installed electrical services (mechanism for electrical power from a utility company or on-site generation to enter a building) or feeders (device to conduct electrical power from one switchboard or panelboard to another) must have a permanently installed electrical meter.

Why?

So service to every building can be metered, allowing the building owner to monitor energy use.

Requirements

- New or replacement electrical service equipment in existing buildings must meet the requirements of Section 130.5(a) applicable to the EPD system being altered

The meter must be able to:

- Show the instantaneous power in kilowatts (kW) being used by the building
- Track energy use in kilowatt-hours (kWh) over a period set by the user

Additional requirements must be met for larger services (see Table 130.5-A)

- For electrical services > 250 kilovolt-amps (kVA): the meter must also record the historical peak demand in kW
- For electrical services > 1000 kVA: the meter must also be able to report the kWh for a fixed-rate period

If utility company provides a metering system, for the service or feeder, that indicates instantaneous kW demand and kWh for a utility-defined period a permanently installed metering system that meets the above specifications is not required. In general, smart meters will meet the requirements.

If a building is not connected to the grid, a customer-owned meter must be in place to monitor energy use. Note that customer-owned meters can be less accurate than a typical utility company revenue-grade meter.

If a building has multiple services, only the service that provides regular electric power needs to meet the requirements. However, it is recommended that back-up power be metered as well.

Compliance Documentation
Complete Table A of NRCC-ELC-01-E.

Separation of Electrical Circuits Section 130.5(b)

EPD systems should be designed for disaggregated measurement of electrical load energy uses downstream from the service meter according to load type and service power (kVA).

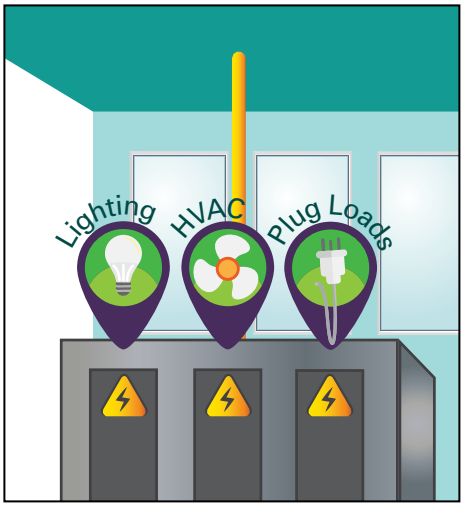
Why?

To help building owners and managers get detailed end-use data to target specific operational improvements.

Requirements:

- Separation is progressive and not required until the service is greater than 50 kVA (unless it pertains to renewable power sources or electric vehicle charging stations (for most small building this requirement will not apply)
- For services >50 kVA - 250 kVA: the requirements are applied to some load groups regardless of actual load, and to other load groups when the group reaches a threshold value of 25 kVA
- For services ≥250 kVA: lighting and plug loads are required to be disaggregated "by floor, type or area." All HVAC, DHW, elevator, and charging station loads can be measured in aggregate, by load type
- See Table 130.5-B of the Standards for specific separation requirements
- For each separate load type, up to 10% of the connected load may be any type
- Entirely new or complete replacement of EPD systems in existing buildings must meet the applicable requirements of Section 130.5(b)

Compliance Documentation:
Complete Table B of the NRCC-ELC-01-E



Once in the building, electricity must make a choice on where to go (e.g., HVAC, lighting, plug loads.)

As electricity flows through the building's wires, voltage drops.

Voltage Drop Section 130.5(c)

Voltage drop is the energy loss as heat in the electrical conductors. Following the limits in CA Electrical Code (Title 24, Part 3), the recommended voltage drop becomes mandatory.

Why?

Voltage drop is caused by resistance in the circuit, and reduces the amount of useful work that can be done by the system. It can be reduced by using larger gauge wire and ensuring that all connections provide good conduction.

Requirements:

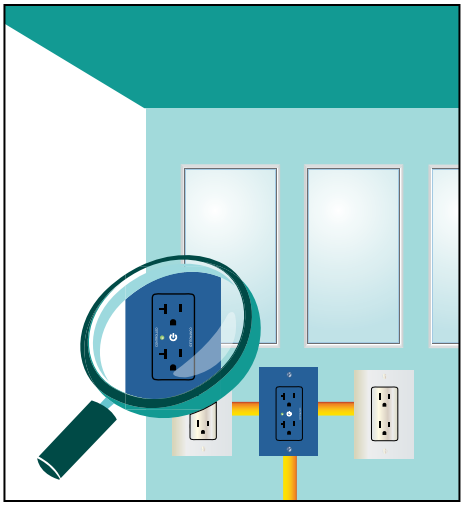
- The combined voltage drop on both feeders and branch circuit conductors to the furthest connected load may not exceed 5%
- Any addition, modification or replacement of both feeders and branch circuits in existing buildings must meet the requirements of Section 130.5(c) for the altered circuits.

Exception:

- Voltage drops specifically permitted by sections 647.4, 695.6 and 695.7 of the CA Electrical Code

Voltage drops can be calculated by hand or through an online or computer program calculator with a few inputs including feeder length and branch circuit lengths, wire gauge by type, and circuit amps. Since electrical loads vary, the calculations are based on design load.

Compliance Documentation:
Complete Table C of NRCC-ELC-01-E. Attach voltage drop calculations to the NRCC-ELC-01-E form.



When the electricity arrives at its final destination, it may need to be controlled.

Circuit Controls for 120-Volt Receptacles Section 130.5(d)

This requirement is designed to minimize plug loads in office areas and other similar space types. It requires that controlled and uncontrolled 120-volt receptacles be provided in each of the following locations: hotel/motel guest rooms, office areas, lobbies, conference rooms, kitchen areas in office spaces, and copy rooms.

Requirements:

- For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Section 130.5(d).
- For each *uncontrolled* receptacle:
  - Provide a *controlled* receptacle within 6 feet OR
  - Use split-wired receptacles, with at least one uncontrolled and one controlled receptacle
- Controlled receptacles must be permanently and durably marked to differentiate them from uncontrolled receptacles
- Circuit controls must be capable of automatically shutting OFF controlled receptacles when the space is typically unoccupied
  - The most common way to meet this requirement is to install a local motion sensor that can be connected to control both general lighting and receptacles, and use the occupancy (not vacancy) control method
  - Another common method is to employ automatic time switch controls with manual override switches
- Plug-in power strips cannot be used to meet this requirement
- For hotel/motel guest rooms:
  - At least 1/2 of the 120-volt receptacles in each room must be controlled receptacles, controlled by captive card controls, occupancy sensing controls, or automatic controls such that no longer than 30 minutes after the guest room has been vacated, power is switched off
- The requirements for controlled receptacles apply to additions and alterations only when the electrical power distribution system is entirely new or when the existing one is being completely replaced

Exceptions:

- Receptacles for refrigerators and water dispensers in kitchen areas
- Clock receptacles ≥6 feet above the floor
- Receptacles for network copiers, fax machines, A/V and data equipment in copy rooms
- Receptacles on circuits rated more than 20 amperes
- Receptacles connected to an uninterruptible power supply (UPS) that are intended to be in continuous use 24/365 and are marked to differentiate them from other uncontrolled receptacles

Compliance Documentation:
Complete Table D of NRCC-ELC-01-E.

Demand Responsive Controls & Equipment Section 130.5(e)

Section 130.5(e) does not require that Demand Response (DR) controls be installed. However, if they are installed to meet another section of the Energy Standards (like lighting, sign message centers, or HVAC), the following control requirements are applicable:

- DR controls and equipment shall be capable of receiving and automatically responding to at least one standards-based messaging protocol which enables DR after receiving a DR signal

Compliance Documentation:
There is no specific DR compliance information required on the NRCC form for this measure.

Forms: Which and When

During Design:

- NRCC-ELC-01-E: Certificate of Compliance for Electrical Power Distribution (which encompasses all the mandatory measures discussed in this fact sheet)
  - Completed and signed by the designer, electrical engineer, or installing contractor
  - Submitted to the building department during permit application, along with applicable plans, voltage drop calculations, or equipment cut sheets (in a separate document or on plan sheets, depending on building department preference)

Why?:

To demonstrate compliance with the energy code for EPD

During Construction:

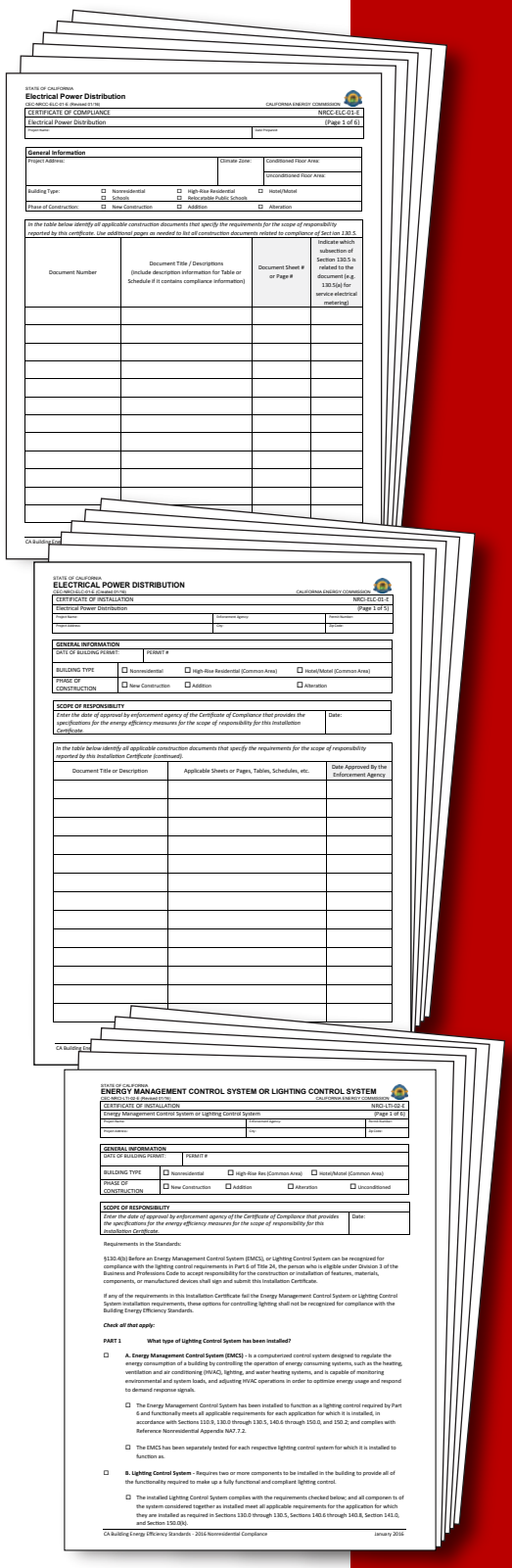
- NRCI-ELC-01-E: Installation Certificate for Electrical Power Distribution
- NRCI-LTI-02-E EMCS: Installation Certificate for Control System (if used to control 120-Volt receptacles)
  - Completed by the installing contractor.
  - These forms should be available for the Inspector when they are onsite

Why?:

To verify the field installation meets or exceeds code

Notes:

- The building department may also need more than one set of compliance forms for the plan reviewer and inspector.
- The NRCC form should also be available onsite for the Building Inspector to use to verify code compliance.



For More Information

EPD Primary Documents & Forms

- Electrical Power Distribution Requirements:
  www.energy.ca.gov/2015publications/CEC-400-2015-033/chapters/chapter_08_electrical_power_distribution.pdf
  - Section 130.5 - Electrical Power Distribution Systems:
    energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1305electricalpowerdistributionsystems.htm
  - Sections 8.2-8.6 of the 2016 Nonresidential Compliance Manual:
    energy.ca.gov/2015publications/CEC-400-2015-033/chapters/chapter_08_electrical_power_distribution.pdf
- Section 130.5(b) - Separation of Electrical Circuits:
  energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1305electricalpowerdistributionsystems.htm#bseparationofelectricalcircuits.htm
  - Table 130.5-B of the Energy Standards:
    energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1305electricalpowerdistributionsystems.htm#table1305bminimumrequirementsforseparationofelectricalload.htm
  - Page 4 of the NRCC-ELC-01-E for specific separation requirements:
- Section 130.5 - Voltage Drop:
  energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1305electricalpowerdistributionsystems.htm#cvoltagedrop.htm
  - Section 8.4 of the 2016 Nonresidential Compliance Manual:
    energy.ca.gov/2015publications/CEC-400-2015-033/appendices/forms/NRCC/2016-NRCC-ELC-01-E-ElectricalPowerDistribution.pdf
- Section130.5(d) - Circuit Controls for 120-Volt Receptacles:
  energycodeace.com/site/custom/public/reference-ace-2016/Documents/section1305electricalpowerdistributionsystems.htm#dcircuitcontrolsfor120voltreceptaclesandcontrolledreceptacles.htm

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
  energy.ca.gov/title24/orc/
  - The Energy Commission's main web portal for Energy Standards, including information, documents, and historical information

Additional Resources

- Energy Code Ace:
  EnergyCodeAce.com
  - An online "one-stop-shop" providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California's investor-owned utilities.

    Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!