

## SERVICE ENTRANCE

### Minimum Size of Residential Service and Feeder Conductors [CEC 310.15(B)(7)(1)]

Copper AWG	AMPS
4 THHN	100
2 THHN	130
2/0 THHN	195

### Grounded Conductor [200.6(A) (1-3)]

**Color:** An insulated grounded (neutral) conductor of 6 AWG and smaller shall be identified by a continuous white outer finish along its entire length [200.6(A)].

*An insulated grounded (neutral) conductor larger than 6 AWG can be re-colored in the field; this re-coloring must occur at time of installation, by a distinctive white or gray marking at its termination.* [200.6(B)(3)]

Conductor Types must be rated for “wet” locations. Conductors exposed to sunlight must be listed marked “sunlight resistant.” [310.10]; e.g., *type THWN conductors.* See article 310.16(C) for complete list conductor types.

### CLEARANCES FOR SERVICE DROPS [CEC 230.9 & 230.24]

- 3 ft. from openable windows, doors, porches, balconies, ladders, stairs, fire escapes & similar locations.
- 8 ft. above any roof surface with a pitch of less than 4 in 12.
- 3 ft. above any roof surface with a pitch greater than 4 in 12.
- 18” when passing over the overhang (eave) portion of the roof, regardless of the pitch, provided the overhang does not exceed 4 ft. and the length of the drop above the overhang does not exceed 6 ft.
- 10 ft. above grade at the service entrance, also at lowest point of the drip loop, and above areas that are accessible only to pedestrians.

- 12 ft. above residential property and driveways.
- 1 ft. from communications wires/cables at any point in the span including the point of attachment to the building. [800.44(A)(4)]

### Service Mast [230.28]

**Only** service conductors shall be attached to the mast.

## SERVICE GROUNDING/BONDING

1). An unspliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the service disconnect enclosure to the grounded conductor (neutral) of the system within the enclosure. [250.28 & .30]

2). Service equipment, enclosures and raceways must be bonded. [250.92(A)] *Bonding shall apply at each end, and to all intervening raceways, boxes, and enclosures, between the service equipment and the grounding electrode.*

The following are acceptable bonding techniques: [250.92(B)]

- Threadless conduit fittings, both setscrew and compression types.

*Note: Standard locknuts must be upgraded to the bonding type.*

- Bonding bushings with jumpers that must be used when concentric knockouts are encountered.

### Grounding Electrodes [250.52]

In the City of Daly City, grounding electrodes for residential service must be A **and** either B or C below:

A). A metal underground water pipe in direct contact with the earth for 10 ft. or more and electrically continuous by bonding around insulating joints to the points of connection of the grounding electrode conductor. *Interior metal water piping located more than 5 ft. from the point of entrance to the building shall not be used as a part of the grounding electrode system or as a conductor to interconnect electrodes that are part of the grounding electrode system.*

B). A concrete encased electrode – an electrode encased by at least 2” of concrete, located within and near the bottom of a concrete foundation or a footing that is in direct contact with the earth, consisting of at least 20 ft. of one or more bare or zinc galvanized steel reinforcing bars or rods (rebar) of not less than ½ inch in diameter, or of at least 20 ft. of bare copper conductor not smaller than 4 AWG. Rebars shall be permitted to be bonded together by the usual steel tie wires or other effective means.

C). A ground rod, copper or copper clad plated steel, ½” to 5/8” in diameter and 8-10 ft. long, driven at least 8 ft. into the ground.

### Note:

- For other types of grounding electrodes and installation procedures refer to NEC 250.52 & .53
- Two different types of grounding electrodes are required; for service upgrades this usually means the water pipe and a ground rod.

## The Grounding Electrode Conductor (GEC)

### Materials (DCMC 15.24.100)

- Copper: solid, stranded, bare or insulated

### Minimum Grounding Electrode Conductor Size

Size of Largest Ungrounded Conductor	Size of GEC
2 or smaller	8
2/0 or 3/0	6

- The GEC to a concrete encased electrode need not exceed #4 AWG in size [250.66(B)]

### Installation

- #8 AWG (min. size) – requires physical protection [250.64(B)]
- #6 AWG – requires protection if subject to physical damage
- #4 – requires protection if subject to severe physical damage (e.g. – along driveway).

*Protection is usually in the form of EMT, armor cable or rigid conduit. All of these methods must be properly bonded at both ends. [250.64(E)]*

- The GEC shall be installed in one continuous length without a splice or joint, unless spliced only by listed irreversible compression-type connectors.

## GEC Connection to Electrode

1). The connection is to be accessible unless buried or encased in concrete. [250.68 (A)]

2). The connection is to be made with listed lugs, clamps or other listed materials.

*Note: If buried, the lug or clamp must be listed for ground contact. [250.70]*

## GEC Connection at the Service

1). The GEC shall be connected to the grounded service conductor (neutral). [250.24(C)]

*This connection typically occurs at the neutral terminal of the main disconnect enclosure.*

## Other Bonding Requirements [250.104]

### Bonding of Piping Systems

A) **Metal Water Piping** systems installed in, or attached to a building, shall be bonded to the service equipment enclosure, the grounded conductor (neutral) at the service, the GEC where of sufficient size, or to the one or more grounding electrodes used. The bonding jumpers shall be sized in accordance with Table 250.66.

B) **Other Metal Piping**, where installed in or attached to a building, including gas piping, that may become energized shall be bonded to the service equipment enclosure, the grounded conductor (neutral) at the service, the grounding electrode conductor where of sufficient size, or to the one or more grounding electrodes used. The points of attachment of the bonding jumper(s) shall be accessible.

## Working Space Required at the Service

[110.26 (A)-(E)]

- 6"6" headroom
- 30" minimum width
- 36" minimum depth measured from the face of enclosure
- Meter height 48" - 66" (PG&E)
- Illumination shall be provided for working space at service equipment installed indoors.

## Daly City Municipal Code Requirements

1). (DCMC 15.24.080) Service entrance conductors shall be enclosed in rigid metal conduit (RMC).

*Note: PG&E requires a minimum of 1-1/4" diameter service mast.*

2). (DCMC 15.24.090) The main service disconnecting means and meter or meters shall be installed at a readily accessible location on the exterior of the building.

All utility service meters and related equipment shall be recessed mounted and screened from public view or painted to match existing building finish, or other method approved by the Authorized Representative.

*Note: A lockable, gated entry compromises this access requirement.*

3). (DCMC 15.24.100) Conductor material shall be copper only

## Other Items

### Panel Directory/Circuit Directory [408.4]

All circuits shall be legibly identified as to the purpose or the use on a circuit directory located on the face or inside of the panel door.

**Terminations:** Each grounded (neutral) conductor shall terminate within the panelboard in an individual terminal that is not also used for another conductor [408.41]. *I.e. One conductor, one screw*

## Circuit Breakers & Size of Conductors

[240.4(D)]

1). 14 AWG size copper conductors are limited to 15 ampere rated breakers.

2). 12 AWG size copper conductors are limited to 20 ampere rated breakers.

### Service Drop [230.54]

Service heads shall be located above the point of attachment of the service conductors to the building.

## Rating of Cabinet/Service Equipment

Main electrical service panels shall have a minimum busbar rating of 200 amperes as required by the California Energy Code for future Photovoltaic installation.

All cabinets installed outdoors must be rated NEMA 3 (this includes cabinets within enclosures designed to "screen equipment from public view").

ECD:G/bldg./brochures/2017

Building Division  
CITY OF DALY CITY  
333 - 90th Street  
Daly City, Calif. 94015-1895

# ELECTRICAL INSTALLATION OF RESIDENTIAL SERVICES

Ref. 2017 California  
Electric Code



**BUILDING DIVISION  
CITY OF DALY CITY**

650.991.8061