

NEC Rules for Traffic Signal and Roadway Lighting Electrical Services

The following article briefly reviews some of the more important NEC rules for electrical services related to traffic signal and roadway lighting. While most of the rules are found in Article 230-Services, other applicable code sections will be covered.

Note: Refer to the 2002 NEC for the full text of code sections cited here.

The rules for an electrical service have two essential purposes:

1. To provide for protection of the service entrance conductors from overload and damage. Since service entrance conductors are unfused, special rules apply. See Figure 1.
2. To provide ready access to, and limit the number of service disconnecting means, to be able to rapidly shut off the power in an emergency.

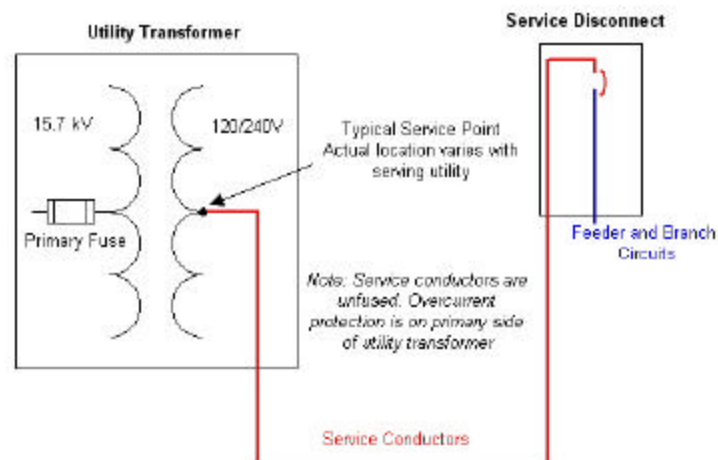


Figure 1

Service Conductors are “unfused” and special rules apply.

What is a “Service”?

The definition of “service conductors” in Article 100 is *the conductors from the service point to the service disconnecting means.*

The service point is *the point of connection between the facilities of the serving utility and the premises wiring.*

The service disconnecting means is referred to in Article 100 as *Service Equipment - The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.*

Service entrance conductors can be overhead or underground. They extend from the terminals of the service equipment to the service point.

Service conductors start at the service point and end at the line side of the service disconnecting means.

Note: Each utility has its own rules on who installs and maintains service conductors, the type of service raceway allowed and rules for meter installations. Watt-hour meters are not required by the NEC, however if one is required, follow the rules in the NEC and any special requirements of the Utility. In addition, your local electrical authority may have rules limiting the type of service raceway allowed and length inside a building or structure.

Special Rules Apply for Service Conductors

Service conductors are unfused; the overcurrent protection is typically located on the primary side of the utility transformer. For this reason service conductors have special rules:

- The type of wiring method is restricted [230.43].
(Unfused service entrance conductors present more of a fire hazard).
- Only service conductors are allowed in a service raceway [230.7]
(A ground fault between service conductors and a feeder could bypass the feeder overcurrent protective device). See Illustration 1.
- Service conductors can not pass through the interior of another building or structure [230.3].
(In the event of a fire all sources of electrical supply to a building have to be able to be de-energized).
- Assured grounding is required for any raceway containing service conductors [250.94].
(Ensures a low impedance path back to the source to clear the fuse quickly in the event of an electrical fault).
- A minimum conductor height for specific locations [230.24].
(Prevent damage from vehicles).
- The minimum attachment point is 10 feet [230.26].
(Prevent contact by persons on the ground).
- Each building or structure is limited to one service drop or lateral [230.2], except that additional services are permitted for different voltages or phases 230.2(D)].
(Multiple services would not allow the power to be quickly turned off in an emergency).

Rules for Minimum Size of Services

Service Conductor Size

Electrical services have a minimum ungrounded conductor size of 8 AWG copper [230.23 (B)]. The grounded (neutral) conductor is sized to carry the maximum

unbalanced neutral load [230.23(C)], and shall not be smaller than required by Table 250.66 (smallest size allowed is 8 AWG copper). An exception to (B) allows that conductors supplying single branch circuits with a limited loads *shall be not smaller than 12 AWG hard-drawn copper or equivalent*.

Note: [250.24(B) (1)] does not require the grounded conductor to be larger than the ungrounded conductor. For a 120V single circuit supplying a warning flasher or similar, the minimum size of the grounded and ungrounded conductors could be 12 AWG.

Disconnect Rating

The disconnecting means is to have an ampere rating of not less than the computed load per Article 220 and not smaller than given in [230.79]:

- (A) 15A for a single branch circuit
- (B) 30A for not more than 2, 2 wire branch circuits
- (C) 100A for a single family dwelling
- (D) 60A for all other installations

A 15 ampere service disconnect could be used with 12 AWG service conductors for a single branch circuit. If a 30A service disconnect is used, then the service conductors would be 8 AWG. Any other service would have to be 60A, or larger if required. For 60A or larger, the rating of the protective device is not larger than the ampacity of the conductors [230.90].

Rules for Service Disconnecting Means

The disconnecting means installed for each service are:

- Grouped [230.71(A)].
- Readily accessible [230.70(A) (1)].
- The maximum number of disconnects is six, which can be six switches or circuit breakers [230.71(A)]. These switches or circuit breakers can be in one enclosure or panelboard, or can be six separate enclosures.
- The disconnect shall be installed outside the building or structure or inside near the point of entry of the service conductors [230.70 (1)].
- The service disconnecting means has to be identified as “suitable for use as service equipment” or “suitable only for use as service equipment”. Each refers to the service disconnect being supplied with a main bonding jumper [250.28]; however “suitable only for use as service equipment” means the main bonding jumper is permanent, and the equipment can not be used as a downstream panelboard where a neutral to ground connection is not allowed. Identified means the equipment is recognized for a specific purpose or function by listing or labeling [Article 100]. An end user could not assemble a service disconnect as it would lack the appropriate listing.

Note: Often local jurisdictions will limit the length of the unfused service entrance conductors (5, 10 or 15 feet) and restrict the type of raceway that can be used (such as rigid metal conduit or Sch 80 PVC).

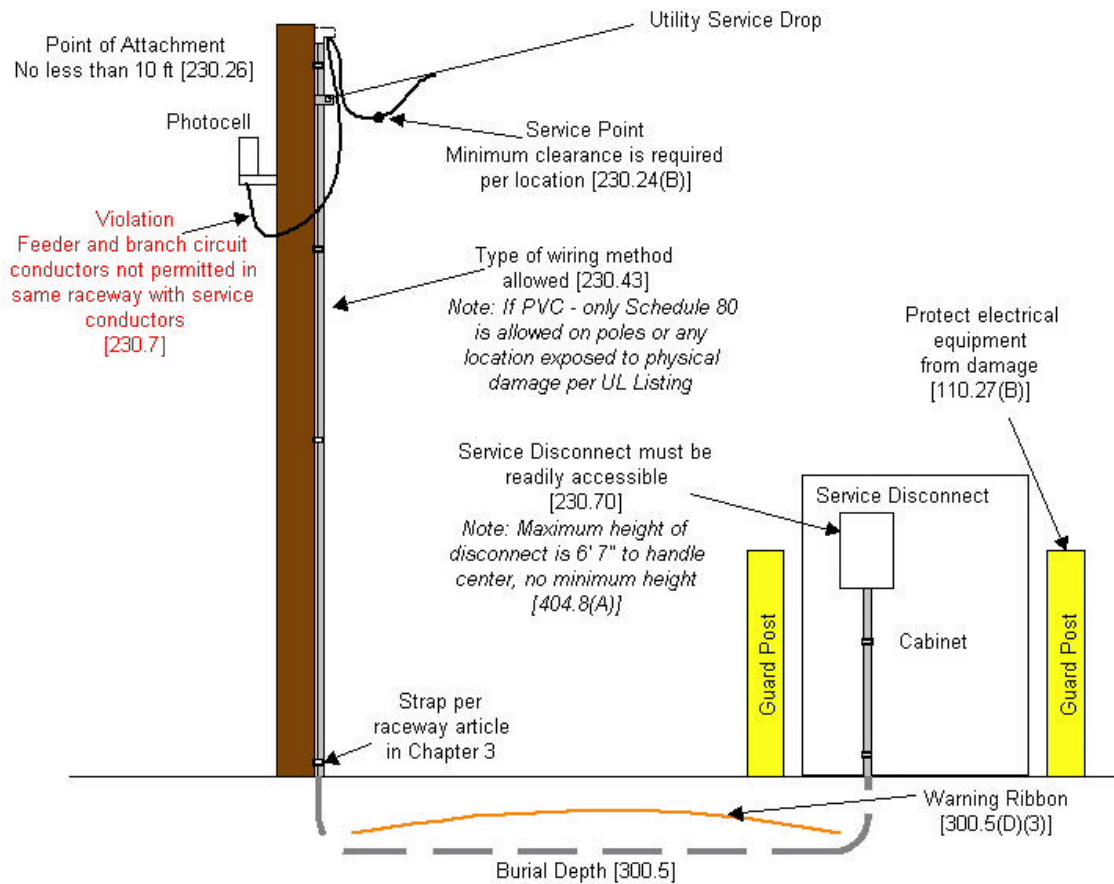


Figure 2
 Typical Signal Service

Other Rules for Services

Many other articles have rules that apply to services. Some of these are:

- Burial depth for raceways and cables [300.5].
- Warning ribbon above service raceways and cables [300.5(3) (D)].
- Assured bonding for service raceways [250.94].
- Grounded conductor brought to every service enclosure [250 (A) System Grounding Connections]
- Protect electrical equipment from damage [110.27(B)].
- If PVC conduit is used on a pole, or to protect conductors from physical damage, it must be Schedule 80 [300] and UL Listing DZYZ: *Schedule 40 conduit is...suitable where not exposed to physical damage. The marking "Schedule 80 PVC" identifies conduit suitable for use where exposed to physical damage and for installation on poles in accordance with the NEC¹.*
- Maximum height of switches and circuit breakers is 6 ft 7 in to the center of the handle [404.8(A)]. There is no minimum height, unless it is for a mobile home [550.32(F)].

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- Each service equipment enclosure must have a grounded conductor [250.26].
- Each service requires a grounding electrode system [250.50].
- Backfed main breakers require a retaining kit [408.16 (F)].
- Only electric service drop conductors can be attached to the service mast [230.28]. (It is a violation to attach antennas and communications cables to service masts - see Illustration 1).



Illustration 1

The radio antenna installed on the service mast is a violation of 230.28, see also 800.52(E), 810.12 and 820.10(C).

¹ Underwriters Laboratories, Inc General Information for Electrical Equipment, 2002 Directory.

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