

## II. Location

### 240.21 Location in Circuit

Overcurrent protection shall be provided in each ungrounded circuit conductor and shall be located at the point where the conductors receive their supply except as specified in 240.21(A) through (H). Conductors supplied under the provisions of 240.21(A) through (H) shall not supply another conductor except through an overcurrent protective device meeting the requirements of 240.4.

**(A) Branch-Circuit Conductors.** Branch-circuit tap conductors meeting the requirements specified in 210.19 shall be permitted to have overcurrent protection as specified in 210.20.

**(B) Feeder Taps.** Conductors shall be permitted to be tapped, without overcurrent protection at the tap, to a feeder as specified in 240.21(B)(1) through (B)(5). The provisions of 240.4(B) shall not be permitted for tap conductors.

The use of the next highest standard-sized device allowed by 240.4(B) is not permitted for feeder tap conductor applications.

For instance, the use of a 500-kcmil THWN copper conductor [380 A, per Table 310.15(B)(16)] as a tap conductor to supply a 400-A rated device is not permitted, nor is it permitted to use the requirement in 240.6 to establish the relationship between the size of the tap conductor and the rating or setting of the feeder OCPD. If the feeder OCPD is 1200 A, a conductor with an ampacity of 400 A is required.

Exhibit 240.7 illustrates a 1/0 AWG, Type THW copper conductor [150 A, from Table 310.15(B)(16)] connected to a 3/0 AWG, Type THW copper feeder conductor with an ampacity of 200 A (increased in size to compensate for voltage drop) that is protected by a 150-A OCPD. Because the ampacity of the 1/0 AWG conductor is not exceeded by the rating of the overcurrent device, the 1/0 AWG conductor is not considered to be a tap conductor based on the definition of *tap conductors* in 240.2. The

overcurrent device protects both sets of conductors in accordance with the basic rule of 240.4, and additional overcurrent protection is not required at the supply or termination point of the 1/0 AWG conductors. Both the 1/0 AWG and the 3/0 AWG conductors are protected by the 150-ampere circuit breaker. In this application, the 1/0 AWG conductors are not tap conductors as defined in 240.2.

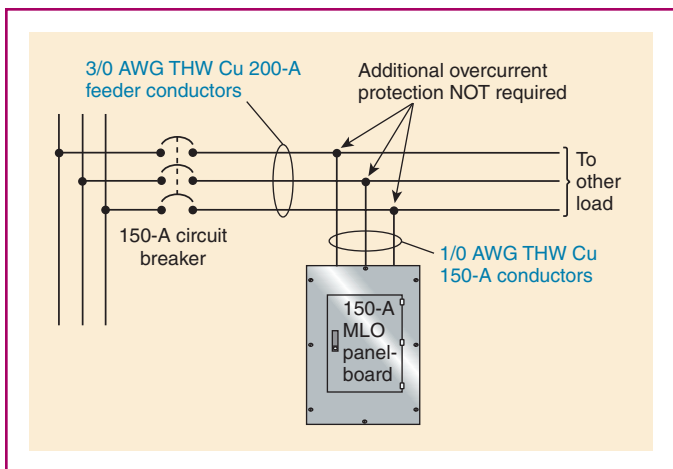
**(1) Taps Not over 3 m (10 ft) Long.** If the length of the tap conductors does not exceed 3 m (10 ft) and the tap conductors comply with all of the following:

- (1) The ampacity of the tap conductors is
  - a. Not less than the combined calculated loads on the circuits supplied by the tap conductors, and
  - b. Not less than the rating of the equipment containing an overcurrent device(s) supplied by the tap conductors or not less than the rating of the overcurrent protective device at the termination of the tap conductors.

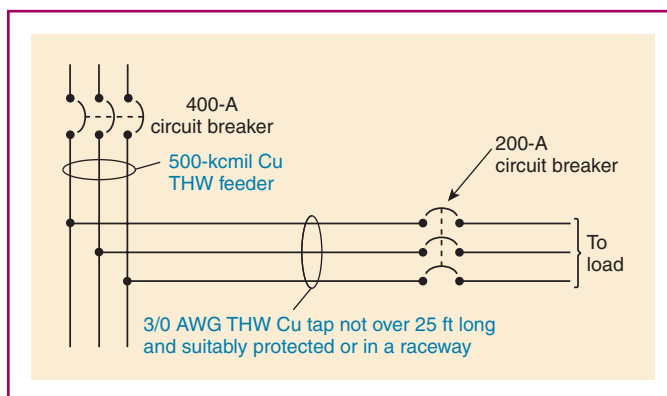
*Exception to b:* Where listed equipment, such as a surge protective device(s) [SPD(s)], is provided with specific instructions on minimum conductor sizing, the ampacity of the tap conductors supplying that equipment shall be permitted to be determined based on the manufacturer's instructions.

- (2) The tap conductors do not extend beyond the switchboard, switchgear, panelboard, disconnecting means, or control devices they supply.
- (3) Except at the point of connection to the feeder, the tap conductors are enclosed in a raceway, which extends from the tap to the enclosure of an enclosed switchboard, switchgear, a panelboard, or control devices, or to the back of an open switchboard.

Exhibit 240.8 illustrates the feeder tap requirements of 240.21(B)(2). In this example, three 3/0 AWG, Type THW copper tap conductors are protected from physical damage by installation in a



**EXHIBIT 240.7** An example in which the sets of 1/0 AWG and the 3/0 AWG conductors are both protected by the 150-ampere circuit breaker.



**EXHIBIT 240.8** An example in which the feeder taps terminate in a single circuit breaker.

raceway. The tap conductors are not more than 25 feet in length between terminations, and the conductors are tapped from 500 kcmil, Type THW copper feeders and terminate in a single circuit breaker with a rating not greater than the ampacity of the tap conductors. The ampacity of the 3/0 AWG, Type THW copper conductor (200 A) is more than one-third the rating of the overcurrent device (400 A) protecting the feeder circuit. See Table 310.15(B)(16) for the ampacity of copper conductors in conduit. Note that the lengths specified in 240.21(B) and (C) apply to the conductors, not to a raceway enclosing the conductors or to the distance between the enclosures in which the tap conductors originate and terminate.

- (4) For field installations, if the tap conductors leave the enclosure or vault in which the tap is made, the ampacity of the tap conductors is not less than one-tenth of the rating of the overcurrent device protecting the feeder conductors.

Informational Note: For overcurrent protection requirements for panelboards, see 408.36.

**(2) Taps Not over 7.5 m (25 ft) Long.** Where the length of the tap conductors does not exceed 7.5 m (25 ft) and the tap conductors comply with all the following:

- (1) The ampacity of the tap conductors is not less than one-third of the rating of the overcurrent device protecting the feeder conductors.
- (2) The tap conductors terminate in a single circuit breaker or a single set of fuses that limit the load to the ampacity of the tap conductors. This device shall be permitted to supply any number of additional overcurrent devices on its load side.
- (3) The tap conductors are protected from physical damage by being enclosed in an approved raceway or by other approved means.

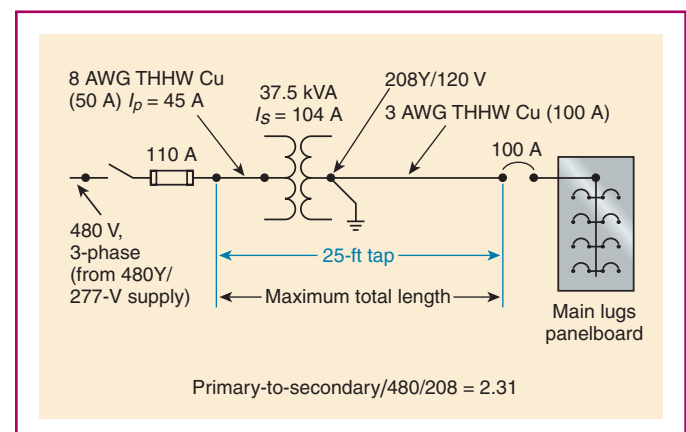
**(3) Taps Supplying a Transformer [Primary Plus Secondary Not over 7.5 m (25 ft) Long].** Where the tap conductors supply a transformer and comply with all the following conditions:

- (1) The conductors supplying the primary of a transformer have an ampacity at least one-third the rating of the overcurrent device protecting the feeder conductors.
- (2) The conductors supplied by the secondary of the transformer shall have an ampacity that is not less than the value of the primary-to-secondary voltage ratio multiplied by one-third of the rating of the overcurrent device protecting the feeder conductors.
- (3) The total length of one primary plus one secondary conductor, excluding any portion of the primary conductor that is protected at its ampacity, is not over 7.5 m (25 ft).
- (4) The primary and secondary conductors are protected from physical damage by being enclosed in an approved raceway or by other approved means.
- (5) The secondary conductors terminate in a single circuit breaker or set of fuses that limit the load current to not more than the conductor ampacity that is permitted by 310.15.

This section covers applications where the conductor length of 25 feet is applied to the primary and secondary conductors (using the length of one primary conductor plus the length of one secondary conductor for the measurement). The primary conductors are tapped to a feeder, and the secondary conductors are required to terminate in a single OCPD. Where the primary conductors are protected in accordance with their ampacity, 240.21(C)(6) permits the entire 25-foot measurement to be applied to the transformer secondary conductors. Exhibit 240.9 illustrates the conditions of 240.21(B)(3)(1) through (5). The overcurrent protection requirements of 408.36 for panelboards and 450.3(B) for transformers also apply.

**(4) Taps over 7.5 m (25 ft) Long.** Where the feeder is in a high bay manufacturing building over 11 m (35 ft) high at walls and the installation complies with all the following conditions:

- (1) Conditions of maintenance and supervision ensure that only qualified persons service the systems.
- (2) The tap conductors are not over 7.5 m (25 ft) long horizontally and not over 30 m (100 ft) total length.
- (3) The ampacity of the tap conductors is not less than one-third the rating of the overcurrent device protecting the feeder conductors.
- (4) The tap conductors terminate at a single circuit breaker or a single set of fuses that limit the load to the ampacity of the tap conductors. This single overcurrent device shall be permitted to supply any number of additional overcurrent devices on its load side.
- (5) The tap conductors are protected from physical damage by being enclosed in an approved raceway or by other approved means.
- (6) The tap conductors are continuous from end-to-end and contain no splices.
- (7) The tap conductors are sized 6 AWG copper or 4 AWG aluminum or larger.
- (8) The tap conductors do not penetrate walls, floors, or ceilings.
- (9) The tap is made no less than 9 m (30 ft) from the floor.

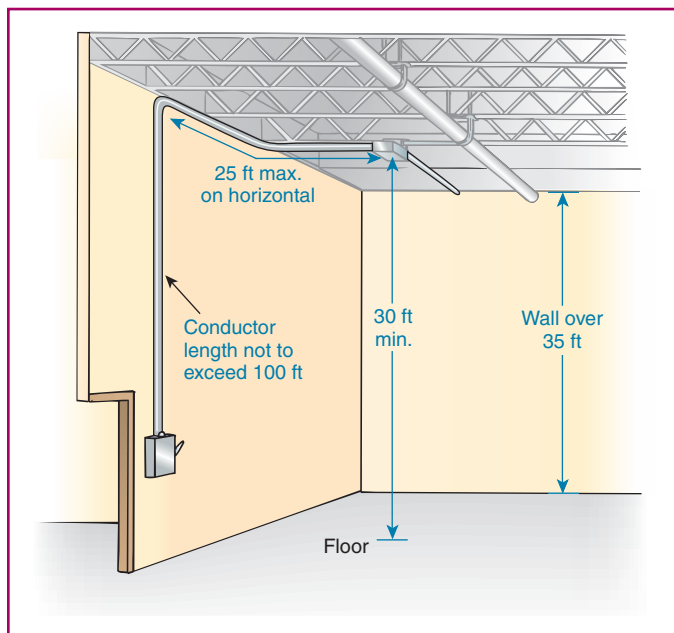


**EXHIBIT 240.9** An example in which the transformer feeder taps (primary plus secondary) are not over 25 feet long.

This section permits a tap of 100 feet for manufacturing buildings with walls that are over 35 feet high where the tap connection is made not less than 30 feet from the floor and conditions of maintenance and supervision ensure that only qualified persons service these systems. Exhibit 240.10 illustrates such an installation.

**(5) Outside Taps of Unlimited Length.** Where the conductors are located outside of a building or structure, except at the point of load termination, and comply with all of the following conditions:

(1) The tap conductors are protected from physical damage in an approved manner.



**EXHIBIT 240.10** An illustration of a feeder tap in a high bay building.

- (2) The tap conductors terminate at a single circuit breaker or a single set of fuses that limits the load to the ampacity of the tap conductors. This single overcurrent device shall be permitted to supply any number of additional overcurrent devices on its load side.
- (3) The overcurrent device for the tap conductors is an integral part of a disconnecting means or shall be located immediately adjacent thereto.
- (4) The disconnecting means for the tap conductors is installed at a readily accessible location complying with one of the following:
  - a. Outside of a building or structure
  - b. Inside, nearest the point of entrance of the tap conductors
  - c. Where installed in accordance with 230.6, nearest the point of entrance of the tap conductors

Section 240.21(B)(5) is a tap conductor requirement that is similar in some respects to an installation of service conductors. The conductors are supplied from a feeder at an outdoor location and run to a building or structure without limitations on the tap conductor length. The tap conductors must be protected against physical damage and must terminate in a single, fused disconnect or a single circuit breaker with a rating that does not exceed the ampacity of the tap conductors. This OCPD provides overload protection for the tap conductors. The fused switch or circuit breaker is installed at a readily accessible location either inside or outside a building or structure and is subject to the applicable requirements covering feeder disconnecting means in Part II of Article 225. The fused switch or circuit breaker is required to be installed inside or outside of the building or structure at a point nearest to where the tap conductors enter the building or structure.