Part III. Construction Specifications

393.100 Sizes and Types of Conductors.

(A) Load Side Utilization Conductor Size. Current-carrying conductors for load side utilization equipment shall be copper and shall be 18 AWG minimum.

Exception: Conductors of a size smaller than 18 AWG, but not smaller than 24 AWG, shall be permitted to be used for Class 2 circuits. Where used, these conductors shall be installed using a Chapter 3 wiring method, shall be totally enclosed, shall not be subject to movement or strain, and shall comply with the ampacity requirements in Table 522.22.

(B) Power Feed Bus Rail Conductor Size. The power feed bus rail shall be 16 AWG minimum or equivalent. For a busbar with a circular cross section, the diameter shall be 1.29 mm (0.051 in.) minimum, and, for other than circular busbars, the area shall be 1.32 mm^2 (0.002 $in.^2$) minimum.

ARTICLE
394 Concealed Knob-and-Tube Wiring

Part I. General

394.1 Scope. This article covers the use, installation, and construction specifications of concealed knob-and-tube wiring.

Part II. Installation

394.10 Uses Permitted. Concealed knob-and-tube wiring shall be permitted to be installed in the hollow spaces of walls and ceilings, or in unfinished attics and roof spaces as provided by 394.23, only as follows:

(1) For extensions of existing installations
(2) Elsewhere by special permission

Knob-and-tube wiring is allowed to be concealed, while open wiring on insulators (Article 398) is required to be exposed. Concealed knob-and-tube wiring is designed for use in hollow spaces of walls, ceilings, and attics and utilizes the free air in such spaces for heat dissipation.

Concealed knob-and-tube wiring is permitted to be installed only for extensions of existing installations or where special permission is granted by the AHJ.

See also

Article 100 for the definition of *special permission*

394.12 Uses Not Permitted. Concealed knob-and-tube wiring shall not be used in the following:

(1) Commercial garages
(2) Theaters and similar locations
(3) Motion picture studios
(4) Hazardous (classified) locations
(5) Hollow spaces of walls, ceilings, and attics where such spaces are insulated by loose, rolled, or foamed-in-place insulating material that envelops the conductors

Blown-in, foamed-in, or rolled insulation prevents the dissipation of heat into the free air space, resulting in a higher conductor temperature, which could cause insulation breakdown and possible insulation ignition. This section prohibits installation of knob-and-tube wiring in hollow spaces that have been weatherized.

394.17 Through or Parallel to Framing Members. Conductors shall comply with 398.17 where passing through holes in structural members. Where passing through wood cross members in plastered partitions, conductors shall be protected by noncombustible, nonabsorbent, insulating tubes extending not less than 75 mm (3 in.) beyond the wood member.

394.19 Clearances.

(A) General. A clearance of not less than 75 mm (3 in.) shall be maintained between conductors and a clearance of not less than 25 mm (1 in.) between the conductor and the surface over which it passes.

(B) Limited Conductor Space. Where space is too limited to provide these minimum clearances, such as at meters, panelboards, outlets, and switch points, the individual conductors shall be enclosed in flexible nonmetallic tubing, which shall be continuous in length between the last support and the enclosure or terminal point.

(C) Clearance from Piping, Exposed Conductors, and So Forth. Conductors shall comply with 398.19 for clearances from other exposed conductors, piping, and so forth.

394.23 In Accessible Attics. Conductors in unfinished attics and roof spaces shall comply with 394.23(A) or (B).

Informational Note: See 310.14(A)(3) for temperature limitation of conductors.

(A) Accessible by Stairway or Permanent Ladder. Conductors shall be installed along the side of or through bored holes in floor joists, studs, or rafters. Where run through bored holes, conductors in the joists and in studs or rafters to a height of not less than 2.1 m (7 ft) above the floor or floor joists shall be protected by substantial running boards extending not less than 25 mm (1 in.) on each side of the conductors. Running boards shall be securely fastened in place. Running boards and guard strips shall not be required where conductors are installed along the sides of joists, studs, or rafters.

(B) Not Accessible by Stairway or Permanent Ladder. Conductors shall be installed along the sides of or through bored holes in floor joists, studs, or rafters.

Exception: In buildings completed before the wiring is installed, attic and roof spaces that are not accessible by stairway or

permanent ladder and have headroom at all points less than 900 mm (3 ft), the wiring shall be permitted to be installed on the edges of rafters or joists facing the attic or roof space.

394.30 Securing and Supporting.

(A) Supporting. Conductors shall be rigidly supported on noncombustible, nonabsorbent insulating materials and shall not contact any other objects. Supports shall be installed as follows:

(1) Within 150 mm (6 in.) of each side of each tap or splice, and
(2) At intervals not exceeding 1.4 m (4½ ft).

Where it is impracticable to provide supports, conductors shall be permitted to be fished through hollow spaces in dry locations, provided each conductor is individually enclosed in flexible nonmetallic tubing that is in continuous lengths between supports, between boxes, or between a support and a box.

(B) Securing. Where solid knobs are used, conductors shall be securely tied thereto by tie wires having insulation equivalent to that of the conductor.

394.42 Devices. Switches shall comply with 404.4 and 404.10(B).

394.56 Splices and Taps. Splices shall be soldered unless approved splicing devices are used. In-line or strain splices shall not be used.

Part III. Construction Specifications

Δ **394.104 Conductors.** Conductors shall be of a type identified in Table 310.4(1).

ARTICLE 395

Δ Outdoor Overhead Conductors over 1000 Volts

395.1 Scope. This article covers the use and installation for outdoor overhead conductors over 1000 volts, nominal.

This article is performance based. It provides the objectives for compliance, rather than prescriptive requirements. These objectives can be met through existing consensus standards for installation of overhead conductors, such as ANSI/IEEE C2, *National Electrical Safety Code (NESC®)*.

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395.10 Uses Permitted. Outdoor overhead conductors over 1000 volts, nominal, shall be permitted only for systems rated over 1000 volts, nominal, as follows:

(1) Outdoors in free air
(2) For service conductors, feeders, or branch circuits

Informational Note: See IEEE C2, *National Electrical Safety Code*, and ANSI/IEEE 3001.2, *Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems*, for additional information on outdoor overhead conductors over 1000 volts.

395.30 Support.

(A) Conductors. Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems for the spacing between conductors shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

(1) Applied voltage
(2) Conductor size
(3) Distance between support structures
(4) Type of structure
(5) Wind/ice loading
(6) Surge protection

(B) Structures. Structures of wood, metal, or concrete, or combinations of those materials, shall be provided for support of overhead conductors over 1000 volts, nominal. Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems and the installation of each support structure shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

(1) Soil conditions
(2) Foundations and structure settings
(3) Weight of all supported conductors and equipment
(4) Weather loading and other conditions such as, but not limited to, ice, wind, temperature, and lightning
(5) Angle where change of direction occurs
(6) Spans between adjacent structures
(7) Effect of dead-end structures
(8) Strength of guy wires and guy anchors
(9) Structure size and material(s)
(10) Hardware

(C) Insulators. Insulators used to support conductors shall be rated for all of the following:

(1) Applied phase-to-phase voltage
(2) Mechanical strength required for each individual installation
(3) Impulse withstand BIL in accordance with Table 490.24(a)

Informational Note: See 395.30(A), (B), and (C), which are not all-inclusive lists.

ARTICLE 396

Messenger-Supported Wiring

Part I. General

396.1 Scope. This article covers the use, installation, and construction specifications for messenger-supported wiring.

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