ARTICLE

800 Communications Circuits

INTRODUCTION TO ARTICLE 800—COMMUNICATIONS CIRCUITS

This article has its roots in telephone technology. Consequently, it addresses telephone and related systems that use twisted-pair wiring. Here are a few key points to remember about Article 800:

- Don't attach incoming communications cables to the service-entrance power mast.
- It's critical to determine the "point of entrance" for these circuits.
- Ground the primary protector as close as practicable to the point of entrance.
- Keep the grounding electrode conductor for the primary protector as straight and as short as possible.
- If you locate communications cables above a suspended ceiling, route and support them to allow access via ceiling panel removal.
- Keep these cables separated from lightning protection circuits.
- If you install communications cables in a Chapter 3 raceway, you must do so in conformance with the *NEC* requirements for the raceway system.
- Special labeling and marking provisions apply—follow them carefully.

Note: The term "Grounding Conductor" previously used in this article has been replaced by either "Bonding Conductor" or "Grounding Electrode Conductor (GEC)" where applicable to more accurately reflect the application and function of the conductor. Figures 800–1 and 800–2

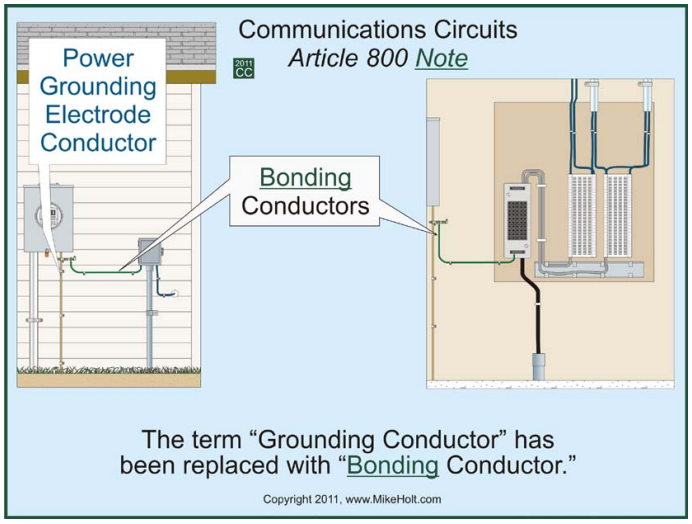

Figure 800–1

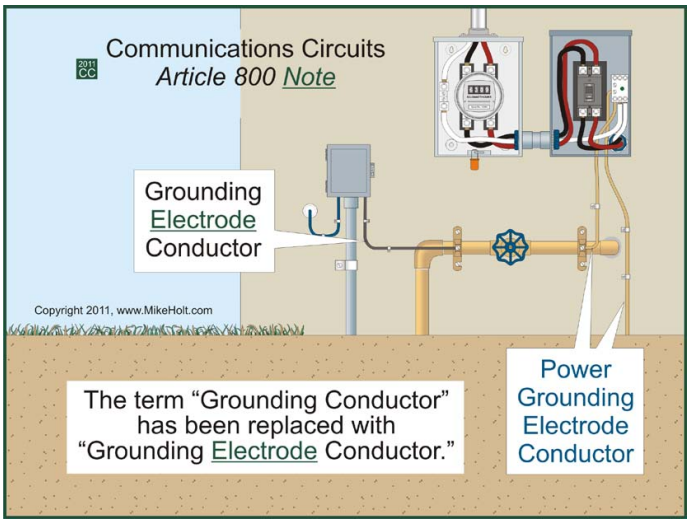

Figure 800–2

Author's Comment: For Articles 800, 810, and 820, the difference between a "bonding conductor" and a "grounding electrode conductor" is where they terminate. The bonding conductor terminates at the intersystem bonding termination; the grounding electrode connects to the power grounding electrode system [250.50].

PART I. GENERAL

800.1 Scope. This article covers circuits that extend voice, audio, video, interactive services, and outside wiring for fire alarms and burglar alarms from the communications utility to the customer's communications equipment up to and including equipment such as a telephone, fax machine, or answering machine [800.2] and communications equipment. Figure 800–3

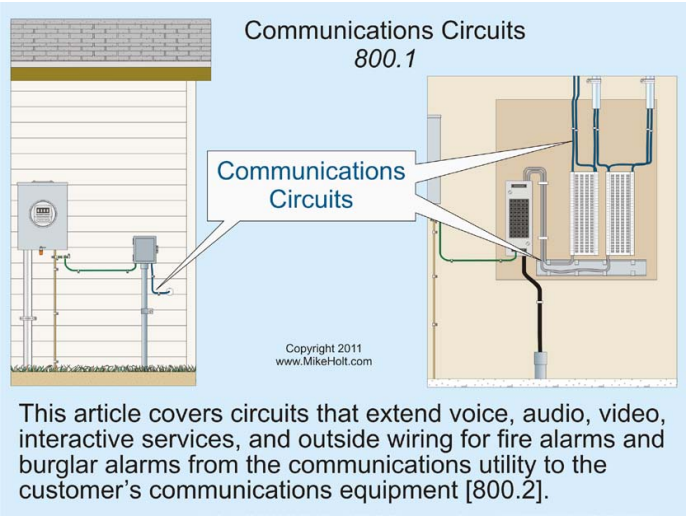

Figure 800–3

Note: The *NEC* installation requirements don't apply to communications utility equipment located outdoors or in building spaces under the exclusive control of the communications utility [90.2(B)(4)]. Figure 800–4

800.2 Definitions.

Abandoned Communications Cable. A communications cable that isn't terminated to equipment and not identified for future use with a tag.

Author's Comment: Section 800.25 requires the accessible portion of abandoned communications cables to be removed.

Communications Circuit. The circuit that extends voice, audio, video, interactive services, and outside wiring for fire alarms and burglar alarms from the communications utility to the customer's communications equipment up to and including terminal equipment such as a telephone, fax machine, or answering machine.

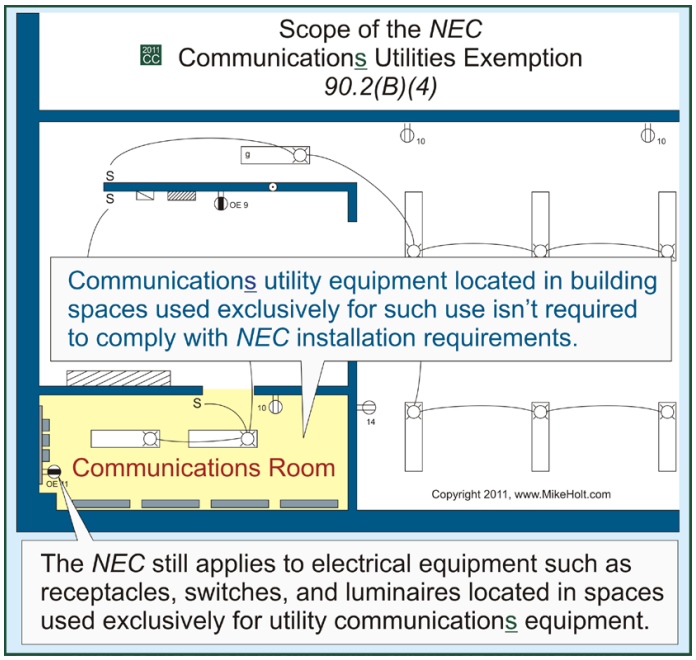

Figure 800–4

Communications Raceway. An enclosed channel of nonmetallic materials designed for holding communications wires and cables in plenum, riser and general-purpose applications. Figure 800–5

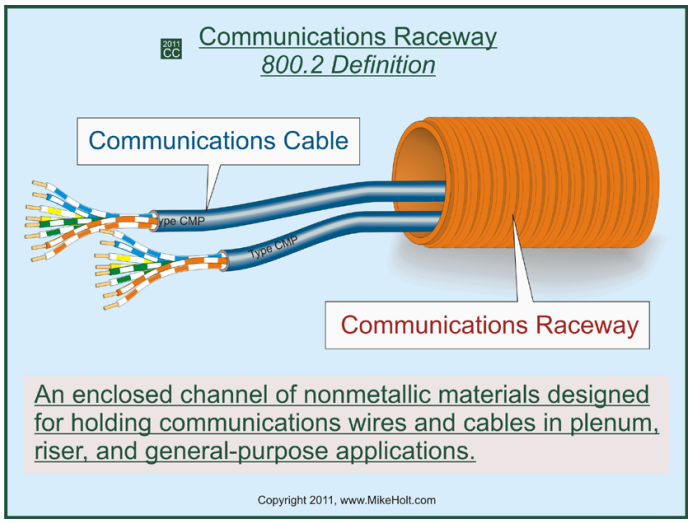

Figure 800–5

Point of Entrance. The point within a building at which the communications cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit or an intermediate metal conduit connected in accordance with 800.100(B). Figure 800–6

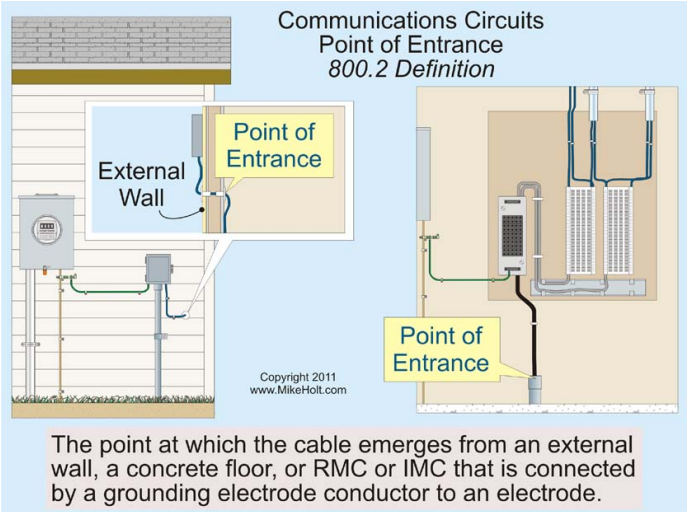

Figure 800–6

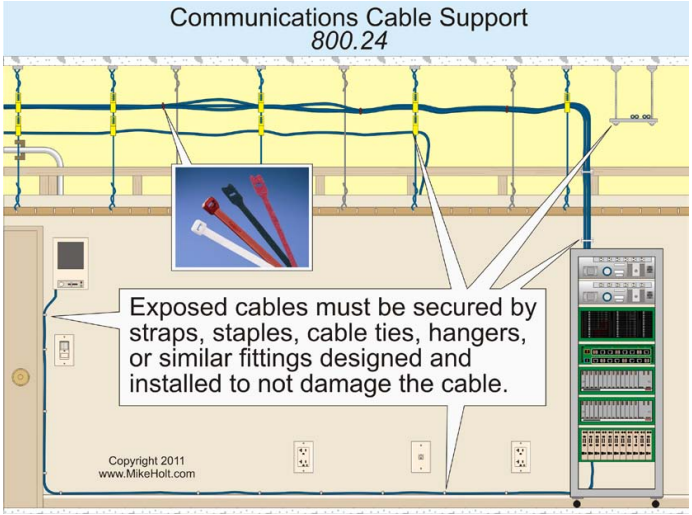

Figure 800–7

800.18 Installation of Equipment. Communications equipment must be listed [800.170] and must be installed in accordance with manufacturer's instructions [110.3(B)].

800.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to equipment must not be prohibited by an accumulation of communications cables that prevent the removal of suspended-ceiling panels. Communications cables must be located so that the suspended-ceiling panels can be moved to provide access to electrical equipment.

800.24 Mechanical Execution of Work. Equipment and communications cabling must be installed in a neat and workmanlike manner. Exposed communications cables must be supported by the structural components of the building so that the communications cable won't be damaged by normal building use. Cables must be secured with straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the communications cable. Figure 800–7

Communications raceways and communications cable assemblies must be securely fastened in place and ceiling-support wires or the ceiling grid must not be used to support communications raceways or communications cables [300.11]. Figure 800–8

> **Author's Comment:** Raceways and cables can be supported by independent support wires attached to the suspended ceiling in accordance with 300.11(A).

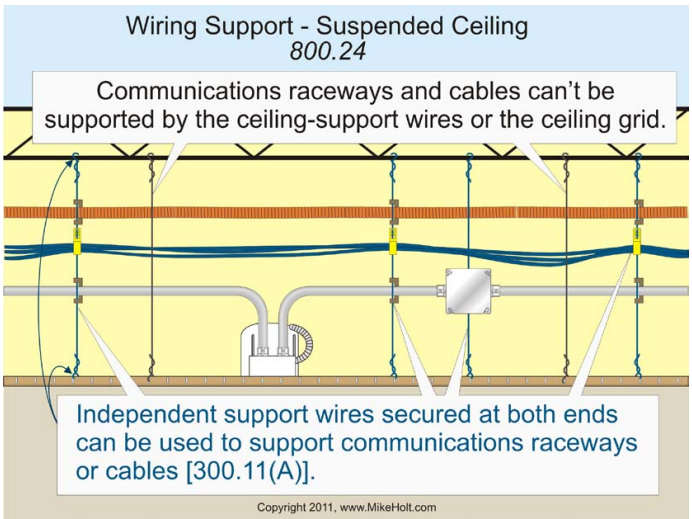

Figure 800–8

Cables installed parallel to framing members or furring strips must be protected where they're likely to be penetrated by nails or screws, by installing the wiring method so it isn't less than 1¼ in. from the nearest edge of the framing member or furring strips, or is protected by a 1/16 in. thick steel plate or the equivalent [300.4(D)]. Figure 800–9

> **Note 1:** Accepted industry practices are described in ANSI/NECA/BICSI 568, *Standard for Installing Commercial Building Telecommunications Cabling* and ANSI/NECA/FOA 301, *Standard for Installing and Testing Fiber Optic Cables.* Figure 800–10

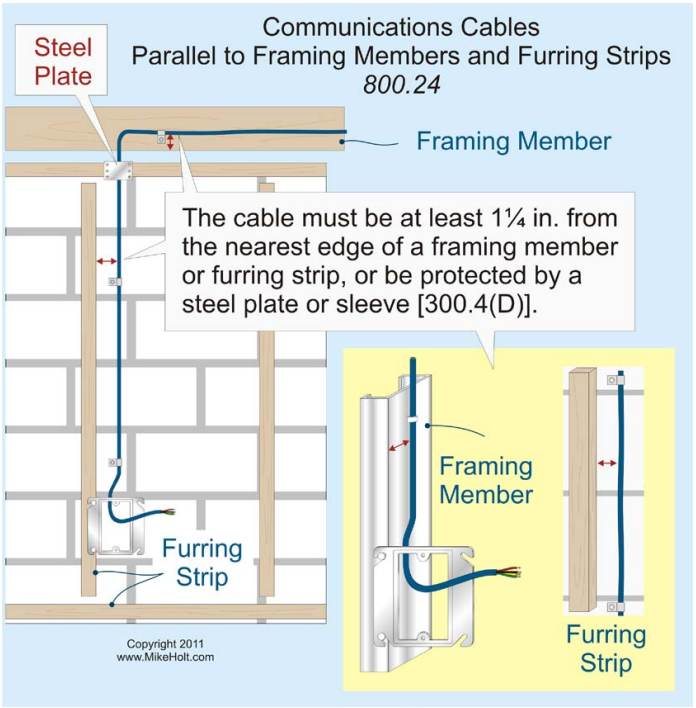

Figure 800–9

Figure 800–10

Author's Comment: For more information about these standards, visit http://www.NECA-NEIS.org/.

Note No. 2: See NFPA 90A-2009, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(B) and (C).

Author's Comment: There are no requirements for support hardware to be listed, but NFPA 90A-2009 has heat release and smoke emissions requirements for "cable ties in sections 4.3.11.2.6.5 (plenums) and 4.3.11.5.5.6 (raised floor plenums).

800.25 Abandoned Cable.

To limit the spread of fire or products of combustion within a building, the accessible portion of communications cable that isn't terminated at equipment and not identified for future use with a tag must be removed [800.2]. Figure 800–11

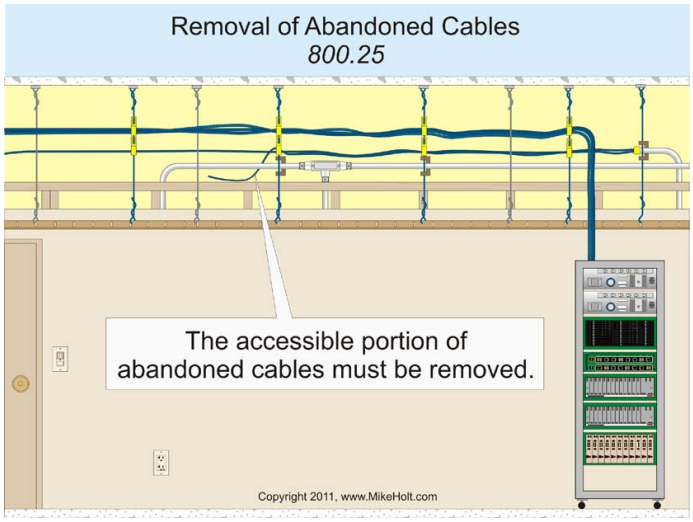

Figure 800–11

Author's Comment: Cables installed in concealed raceways aren't considered "accessible," therefore they're not required to be removed.

Cables identified for future use must be with a tag that can withstand the environment involved. Figure 800–12

800.26 Spread of Fire or Products of Combustion.

Electrical circuits and equipment must be installed in such a way that the spread of fire or products of combustion won't be substantially increased. Openings in fire-rated walls, floors, and ceilings for electrical equipment must be firestopped using methods approved by the authority having jurisdiction to maintain the fire-resistance rating of the fire-rated assembly. Figure 800–13

Author's Comment: Firestop material is listed for the specific types of wiring methods and construction structures.

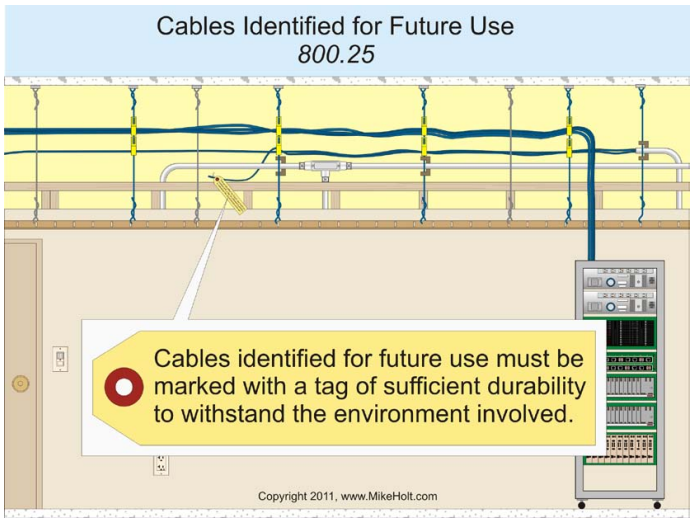

Figure 800–12

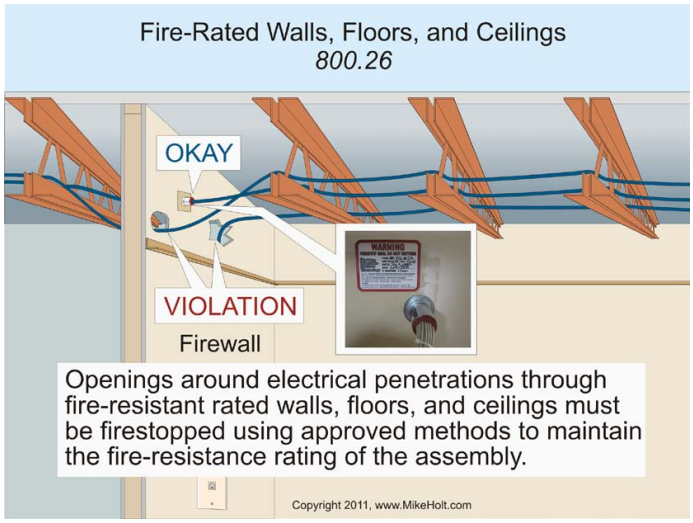

Figure 800–13

Note: Directories of electrical construction materials published by qualified testing laboratories contain listing and installation restrictions necessary to maintain the fire-resistive rating of assemblies. Outlet boxes must have a horizontal separation not less than 24 in. when installed in a fire-rated assembly, unless an outlet box is listed for closer spacing or protected by fire-resistant "putty pads" in accordance with manufacturer's instructions.

PART II. CABLES OUTSIDE AND ENTERING BUILDINGS

800.44 Overhead (Aerial) Communications Cables.

(B) Above Roofs. Overhead (aerial) communications cables must have a vertical clearance of at least 8 ft from all points of roofs above which they pass.

Ex 1: Auxiliary buildings such as garages.

Ex 2: Cable clearance over the roof overhang can be reduced from 8 ft to 18 in. if no more than 6 ft of overhead (aerial) conductors pass over no more than 4 ft of roof and they terminate to a raceway mast or other approved support.

800.47 Underground Communications Wires and Cables Entering Buildings. The requirements that insulated conductors and cables in wet locations be listed for wet locations [310.10(C) do not apply to communications cables.

800.48 Unlisted Cables Entering Buildings. Unlisted communications cables can be installed in building spaces other than risers, ducts, or plenum spaces as described in 300.22(C), if the length of the cable within the building from its point of entrance doesn't exceed 50 ft and the cable terminates in an enclosure or primary protector. Figure 800–14

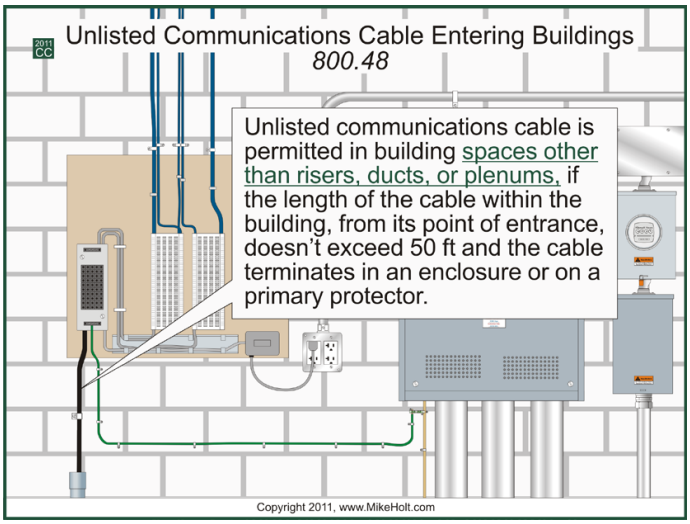

Figure 800–14

Note 2: The primary protector must be located as close as practicable to the point at which the cable enters the building [800.90(B)]. Therefore, unlisted outside plant communications cables may not be permitted to enter the building if it's practicable to place the primary protector closer than 50 ft to the point of entrance.

Author's Comment: The "point of entrance" is defined as the point within the building where the cable emerges from an external wall, from a concrete floor slab, or from rigid metal conduit or intermediate metal conduit connected to an electrode by a grounding conductor in accordance with 800.100 [800.2].

800.53 Lightning Conductors. If feasible, a separation not less than 6 ft must be maintained between communications wiring and lightning protection conductors. Figure 800–15

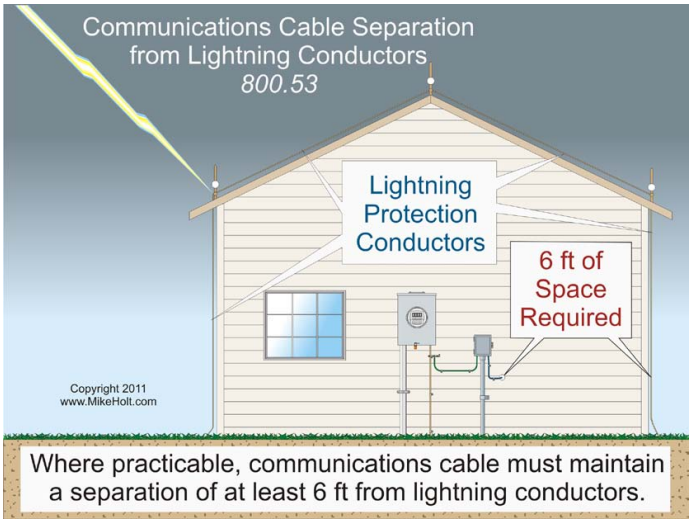

Figure 800–15

Author's Comment: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor [800.100(A)(4)] helps reduce differences in potential between communications circuits and other metallic systems during lightning events.

800.93 Grounding or Interruption of Metallic Sheath Members of Communications Cables.

(A) Entering Buildings. In installations where the communications cable enters a building, the metallic sheath members of the cable can be grounded as specified in 800.100 or interrupted by an insulating joint or equivalent device as close as practicable to the point of entrance. Figure 800–16

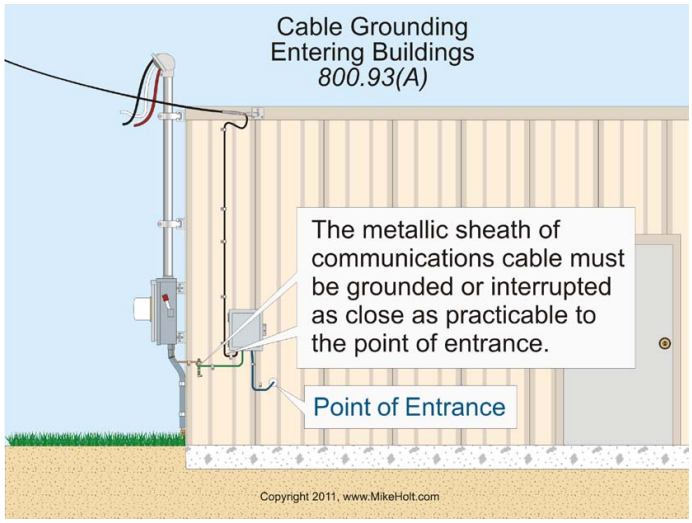

Figure 800–16

PART III. PROTECTION

800.90 Primary Protection.

(A) Application. A listed primary protector is required for each communications circuit.

(B) Location. The primary protector must be located as close as practicable to the point of entrance.

Note: The point of entrance is defined as the point within the building where the communications cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit or an intermediate metal conduit connected to an electrode by a grounding electrode conductor in accordance with 800.100 [800.2].

PART IV. GROUNDING METHODS

800.100 Cable and Primary Protector Bonding and Grounding.

The primary protector and the metallic member of cable sheaths must be bonded or grounded in accordance with (A) through (D).

(A) Bonding Conductor or Grounding Electrode Conductor.

(1) Insulation. Listed and be insulated, covered, or bare.

(2) Material. Copper or other corrosion-resistant conductive material, stranded or solid.

(3) Size. Not be smaller than 14 AWG with a current-carrying capacity of not less than the grounded metallic sheath member or protected conductor of the communications cable, but not required to be larger than 6 AWG.

(4) Length. As short as practicable and for one- and two-family dwellings, the bonding conductor or grounding electrode conductor must not exceed 20 ft in length. Figure 800–17

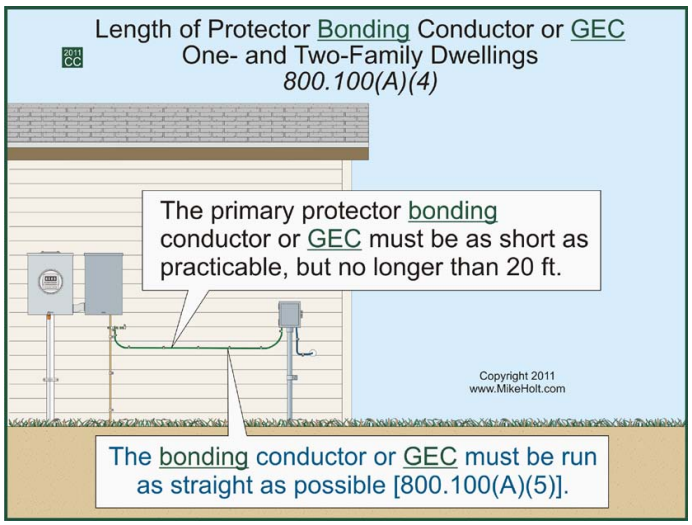

Figure 800–17

Note: Limiting the length of the bonding conductor or grounding electrode conductor helps limit induced potential (voltage) differences between the building's power and communications systems during lightning events.

Ex: If the bonding conductor or grounding electrode conductor is over 20 ft in length for one- and two-family dwellings, a separate ground rod not less than 5 ft long [800.100(B)(3)(2)] with fittings suitable for the application [800.100(C)] must be installed. The additional ground rod must be bonded to the power grounding electrode system with a minimum 6 AWG conductor [800.100(D)].

(5) Run in Straight Line. Run in as straight a line as practicable.

Author's Comment: Lightning doesn't like to travel around corners or through loops, which is why the grounding electrode conductor or bonding jumper must be run as straight as practicable.

(6) Physical Protection. The bonding conductor and grounding electrode conductor must not be subject to physical damage. If installed in a metal raceway, both ends of the raceway must be bonded to the contained conductor or connected to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

Author's Comment: Installing the bonding conductor or grounding electrode conductor in PVC conduit is a better practice.

(B) Electrode. The bonding conductor or grounding electrode conductor must be connected in accordance with (B)(1), (B)(2), or (B)(3):

(1) Buildings or Structures with an Intersystem Bonding Termination. The bonding conductor for the primary protector and the metallic sheath of communications cable must terminate to the intersystem bonding termination as required by 250.94. Figure 800–18

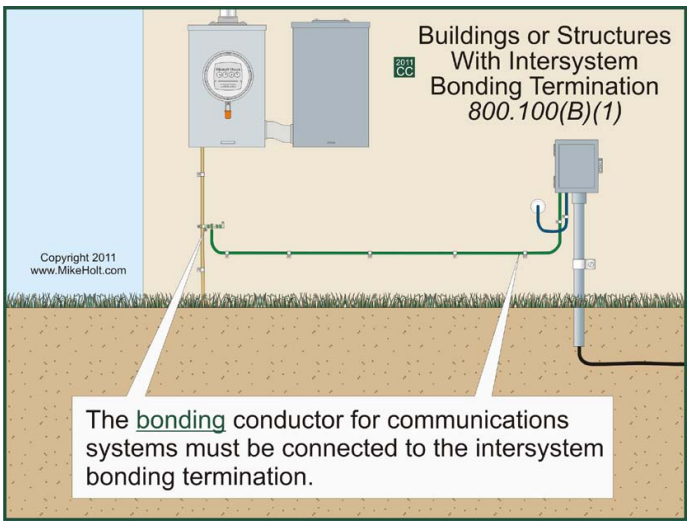

Figure 800–18

Note: According to the Article 100 definition, an "Intersystem Bonding Termination" is a device that provides a means to connect bonding conductors for communications systems to the grounding electrode system, in accordance with 250.94. Figure 800–19

(2) Building/Structure Without Intersystem Bonding Termination. The bonding conductor or grounding electrode conductor must terminate to the nearest accessible: Figure 800–20

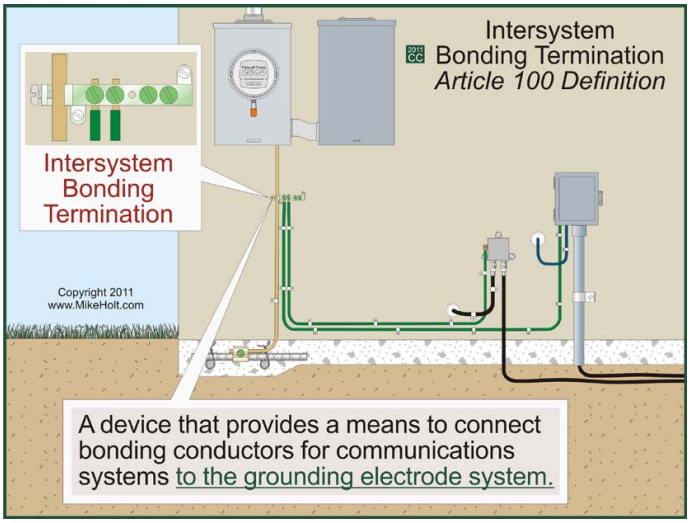

Figure 800–19

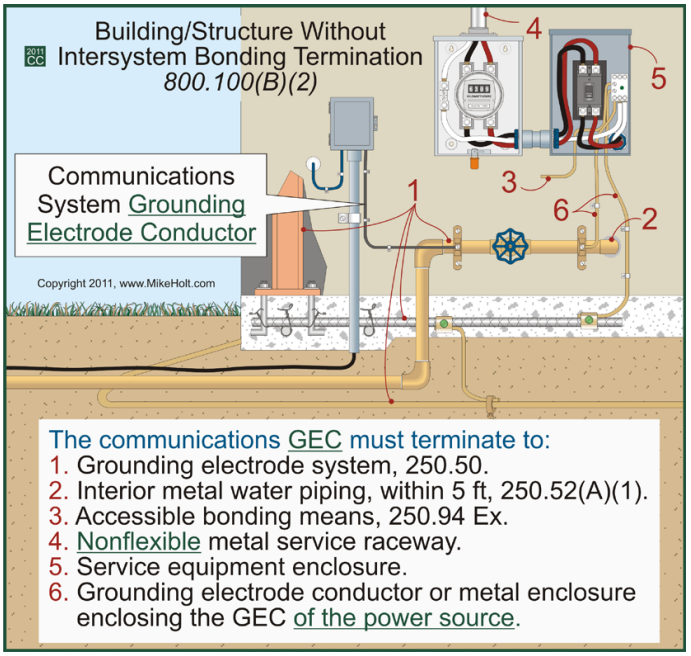

Figure 800–20

(1) Building/structure grounding electrode system [250.50].

(2) Interior metal water piping system, within 5 ft from its point of entrance [250.52(A)(1)].

(3) Accessible means external to the building, as covered in 250.94 Ex.

(4) Nonflexible metallic service raceway.

(5) Service equipment enclosure.

(6) Grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service.

(7) Grounding electrode conductor or the grounding electrode of a remote building/structure disconnecting means [250.32].

The intersystem bonding termination must be mounted on the fixed part of an enclosure so that it won't interfere with the opening of an enclosure door. A bonding device must not be mounted on a door or cover even if the door or cover is nonremovable.

(3) In Buildings or Structures Without Intersystem Bonding Termination or Grounding Means. The grounding electrode conductor must connect to:

(1) Any individual grounding electrode described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4).

(2) Any individual grounding electrode described in 250.52(A)(6) and (A)(7), or to a ground rod not less than 5 ft long and ½ in. in diameter located not less than 6 ft from electrodes of other systems.

Figure 800–21

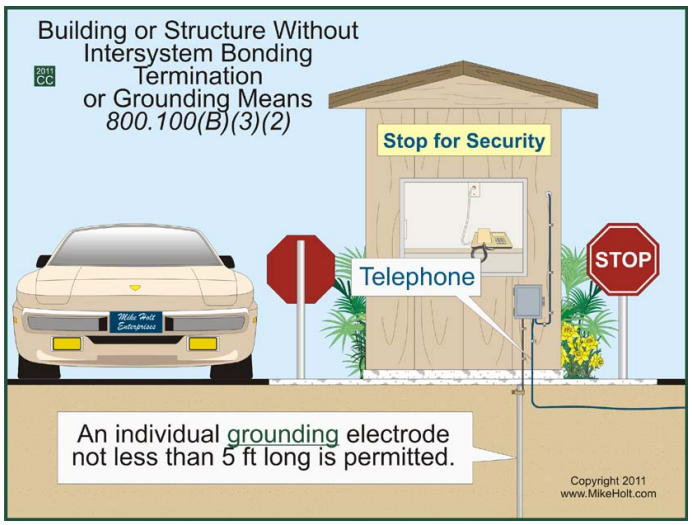

Figure 800–21

Author's Comment: The reason communications ground rods only need to be 5 ft long is because that's the length the telephone company used before the *NEC* contained requirements for communications systems. Telephone company ground rods were only 5 ft long because that's the length that would fit in their equipment trailers.

(C) Electrode Connection. Terminations at the grounding electrode must be by exothermic welding, listed lugs, listed pressure connectors, or listed clamps. Grounding fittings that are concrete-encased or buried in the earth must be listed for direct burial [250.70].

(D) Bonding of Electrodes. If a separate grounding electrode, such as a ground rod, is installed for a communications system, it must be bonded to the building's power grounding electrode system with a minimum 6 AWG conductor. Figure 800–22

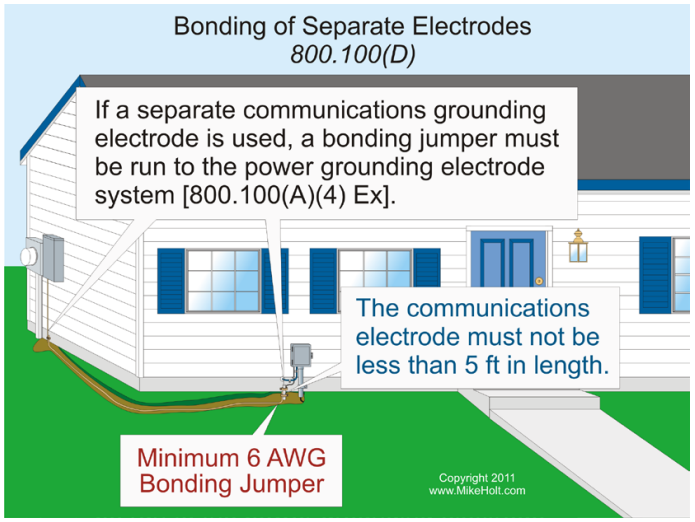

Figure 800–22

Note 2: Bonding of electrodes helps reduce induced potential (voltage) between the power and communications systems during lightning events. Figure 800–23

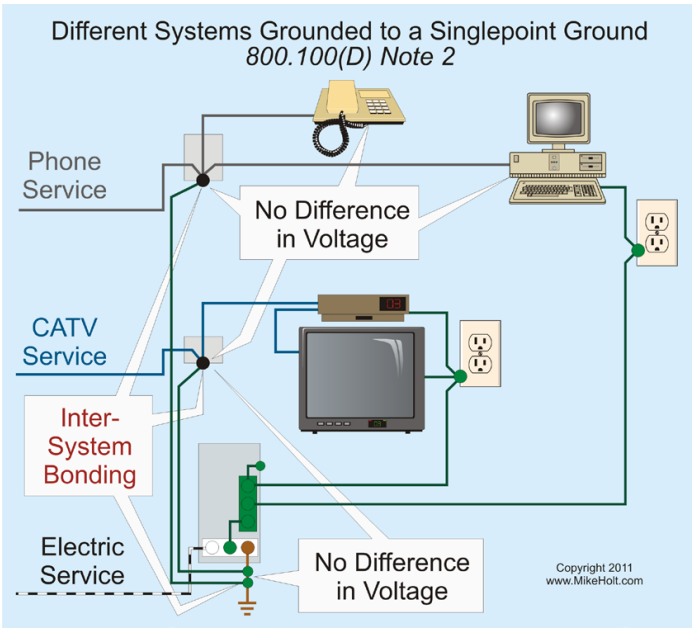

Figure 800–23

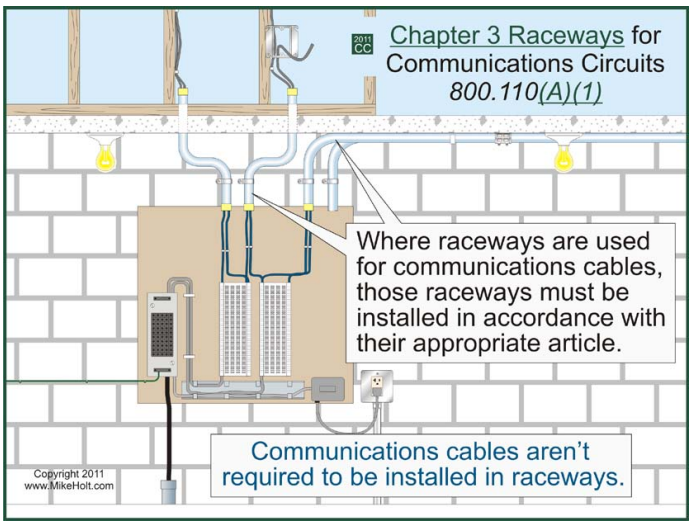

Figure 800–24

PART V. INSTALLATION METHODS WITHIN BUILDINGS

800.110 Raceways for Communications Wires and Cables.

(A) Types of Raceways.

(1) Chapter 3 Raceways. Communications cables can be installed in any Chapter 3 raceway in accordance with the requirements of Chapter 3. Figure 800–24

(2) Other Permitted Raceways. Communications cables can be installed in a listed communications raceway. If communications cables are installed in a listed communications nonmetallic raceway, the raceway must be installed in accordance with 362.24 through 362.56. Figure 800–25

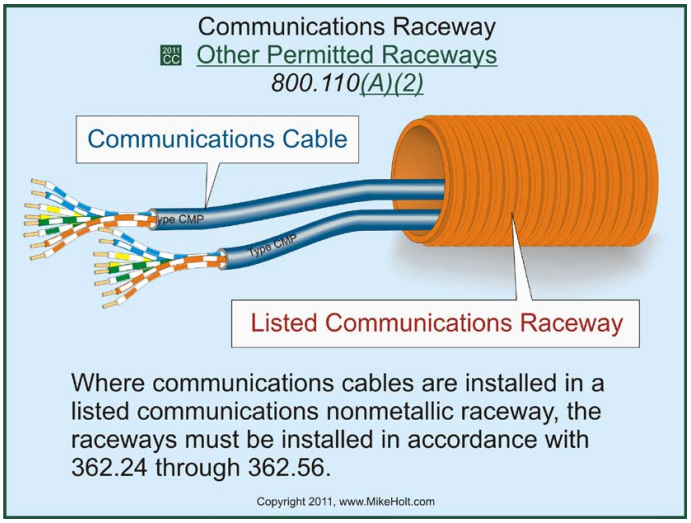

Figure 800–25

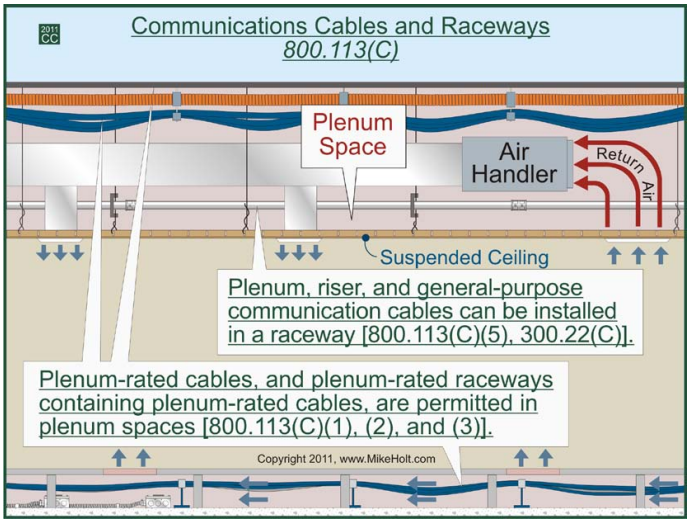

Figure 800–26

Author's Comment: In other words, listed communications raceways must be installed according to the following rules for ENT:

- 362.24 Bending radius
- 362.26 Maximum total bends between pull points, 360 degrees
- 362.28 Trimmed to remove rough edges
- 362.30 Supported every 3 ft, and within 3 ft of any enclosure
- 362.48 Joints between tubing, fittings, and boxes

(B) Raceway Fill for Communications Wires and Cables. Raceway fill limitations of 300.17 don't apply to communications cables installed in a raceway.

800.113 Installation of Communications Cables and Communications Raceways.

(A) Listing. Communications cables installed within buildings must be listed.

Ex: Unless the length of the cable from its point of entrance doesn't exceed 50 ft as permitted by 800.48.

(C) Plenum Spaces. The following cables and raceways are permitted in plenum spaces as described in 300.22(C): Figure 800–26

(1) Type CMP cables

(2) Listed plenum communications raceways

(3) Type CMP cables installed in plenum raceways

(4) Types CMP cables and plenum communications raceways supported by open metallic cable trays or cable tray systems

(5) Types CMP, CMR, CMG, CM, and CMX cables installed in raceways in compliance with 300.22(C)

(G) Cable Trays. The following cables and raceways can be installed in cable trays:

(1) Types CMP, CMR, CMG, and CM cables

(2) Communications raceways

(3) Types CMP, CMR, CMG, and CM cables installed in communications raceways

(I) Other Building Locations.

(1) Types CMP, CMR, CMG, and CM cables

(2) A maximum of 10 ft of exposed Type CMX cable in nonconcealed spaces

(3) Communications raceways

(4) Types CMP, CMR, CMG, and CM cables installed in communications raceways

(5) Listed communication wires and Types CMP, CMR, CMG, CM, and CMX cables and installed in a Chapter 3 raceway

(K) One- and Two-Family Dwellings. The following cables and raceways can be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

(1) Types CMP, CMR, CMG, and CM cables

(2) Type CMX cable less than ¼ in. in diameter

(3) Plenum, riser, and general-purpose communications raceways installed in compliance with 800.110

(4) Types CMP, CMR, CMG, and CM cables installed in plenum, riser, or general-purpose communications raceways

(5) Listed communication wires and Types CMP, CMR, CMG, CM, and CMX cables and installed in a raceway of a type included in Chapter 3

800.133 Installation of Communications Cables.

(A) Separation from Power Conductors.

(1) In Raceways, Routing Assemblies, Cables, Cable Trays, and Enclosures. Figure 800–27

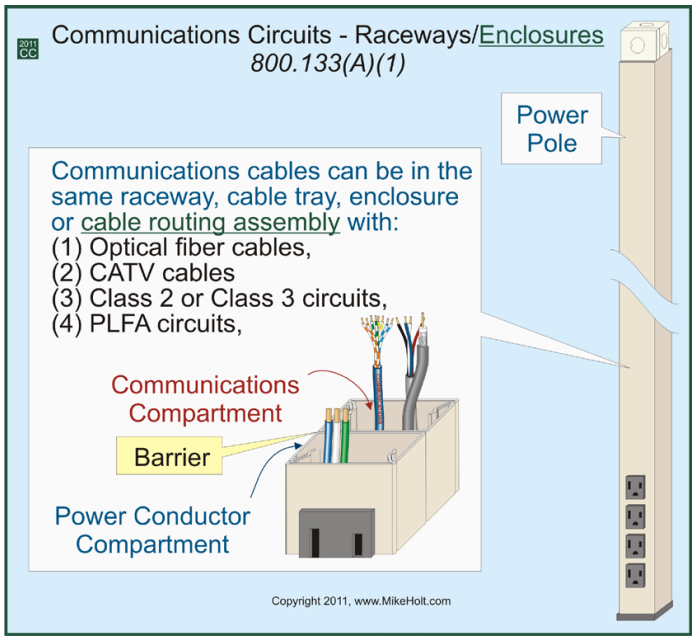

Figure 800–27

(a) With Optical Fiber Cables. Communications cables can be in the same raceway, cable tray, cable routing assembly, or enclosure with conductors of any of the following:

(1) Optical fiber cables in accordance with Parts I and IV of Article 770.

(2) Coaxial cables in compliance with Parts I and IV of Article 820.

(b) With Other Circuits. Communications cables can be in the same raceway, cable tray, cable routing assembly, or enclosure with conductors of any of the following:

(1) Class 2 and Class 3 circuits in compliance with Parts I and III of Article 725.

(2) Power-limited fire alarm circuits in compliance with Parts I and III of Article 760.

(c) Class 2, and Class 3 Circuits. Communications conductors can be within the same cable with Class 2 or Class 3 conductors, provided that communications cables in accordance with Article 800 are used [725.139(D)(1)]. Figure 800–28

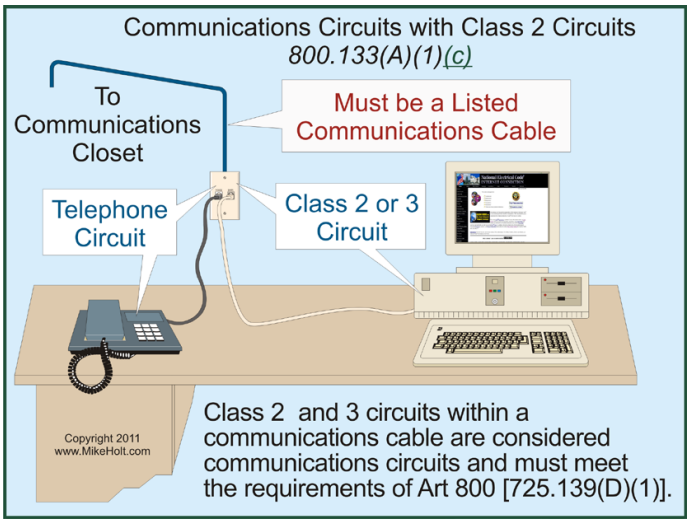

Figure 800–28

Author's Comments:

- A common application of this requirement is when a single cable is used for both voice communications and data.
- Listed Class 2 cables have a voltage rating of 150V [725.179(G)], whereas communications cables have a voltage rating of 300V [800.179].

(d) With Power Conductors in Same Raceway or Enclosure. Communications conductors must not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric power or Class 1 circuits.

Ex 1: Communications circuits can be within the same enclosure with conductors of electric power and Class 1 circuits, where separated by a permanent barrier or listed divider.

Author's Comment: Separation is required to prevent a fire or shock hazard that can occur from a short between the communications circuits and the higher-voltage circuits.

Ex 2: Communications conductors can be mixed with power conductors if the power circuit conductors are only introduced to supply power to communications equipment. The power circuit conductors must maintain a minimum ½ in. separation from the communications circuit conductors.

(2) Other Applications. Communications circuits must maintain 2 in. of separation from electric power or Class 1 circuit conductors.

Ex 1: Separation isn't required if electric power or Class 1 circuit conductors are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, or underground feeder cables, or communications cables are in a raceway. Figure 800–29

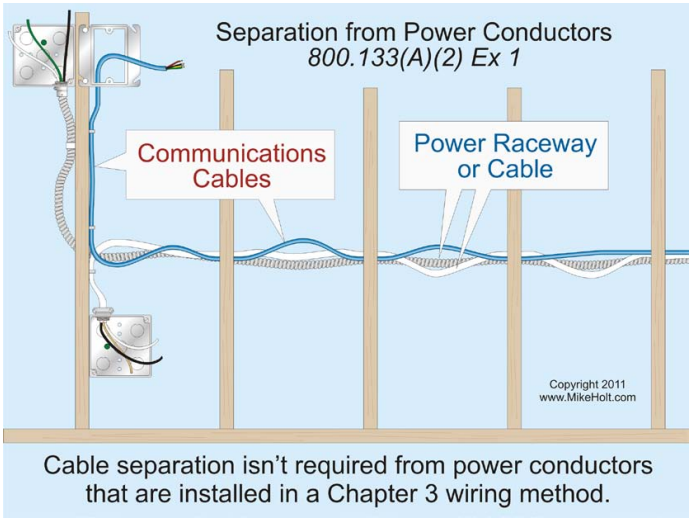

Figure 800–29

(B) Support of Communications Cables. Communications cables aren't permitted to be strapped, taped, or attached to the exterior of any raceway as a means of support. Figure 800–30

> **Author's Comment:** Exposed cables must be supported by the structural components of the building so that the cable won't be damaged by normal building use. The cables must be secured by straps, staples, cable ties, hangers, or similar fittings designed and installed in a manner that won't damage the cable [800.24].

Ex: Overhead (aerial) spans of communications wiring can be attached to a raceway-type mast intended for the attachment and support of such conductors. Figure 800–31

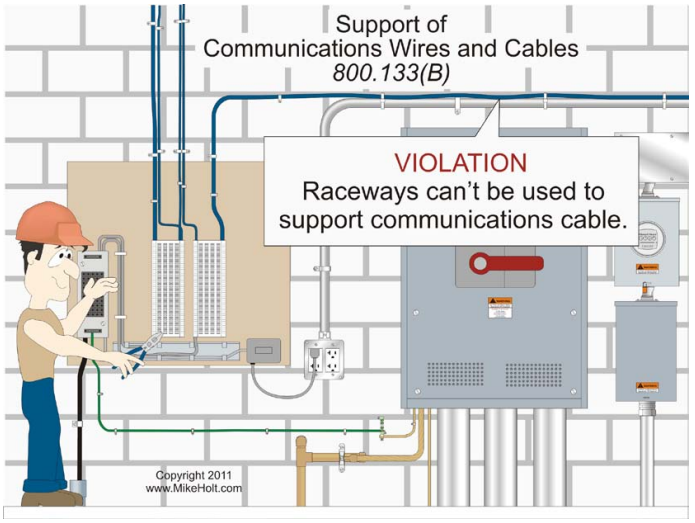

Figure 800–30

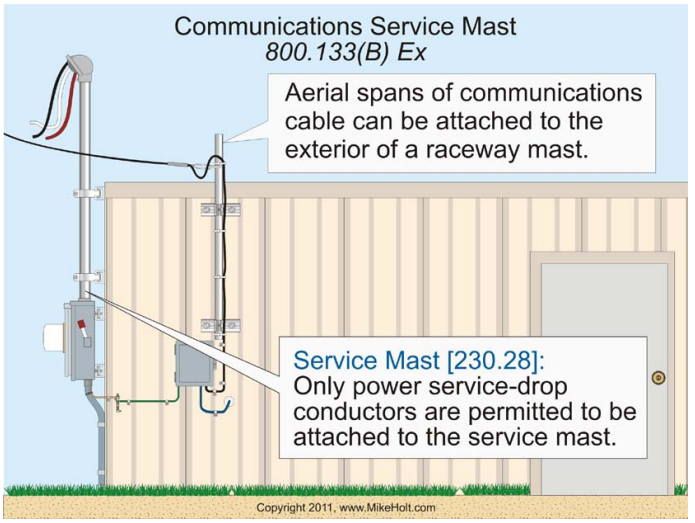

Figure 800–31

> **Author's Comment:** Communications cables must not be supported by, or attached to, the power service mast [230.28].

800.154 Applications of Communications Cables and Communications Raceways. Listed communications cables and raceways can be installed as indicated in Table 800.154(A) as limited by 800.113, and cable substitutions in accordance with Table 800.154(B). Figure 800–32

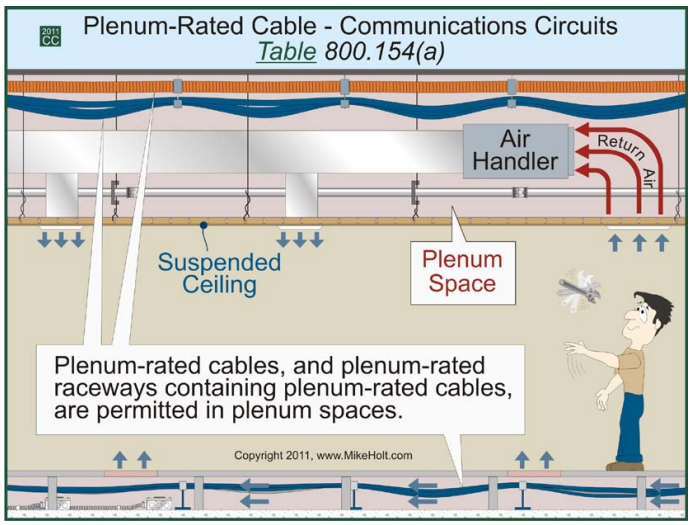

Figure 800–32

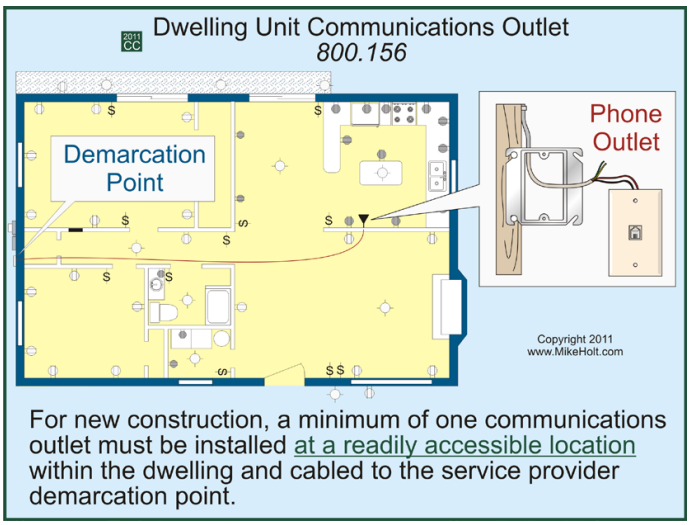

Figure 800–33

800.156 Dwelling Unit Communications Outlet. One communications outlet must be installed in a readily accessible area within each dwelling unit and cabled to the service provider's demarcation point. Figure 800–33

PART VI. LISTING REQUIREMENTS

800.179 Listing and Marking of Communications Cables. Communications cables must be listed. Communications wires and cables must have a voltage rating of not less than 300 volts. The cable voltage rating is not be marked on the cable or on the undercarpet communications wire.

ARTICLE 800 Practice Questions

Please use the 2011 *Code* book to answer the following questions.

Article 800. Communications Circuits

1. Communications circuits are circuits that extend _____ and outside wiring for fire alarms and burglar alarms from the communications utility to the customer's communications equipment up to and including equipment such as a telephone, fax machine, or answering machine.

   (a) voice
   (b) audio and video
   (c) interactive services
   (d) all of these

2. Communications cables not terminated at both ends with a connector or other equipment and not identified for future use with a tag are considered abandoned.

   (a) True
   (b) False

3. The circuit that extends voice, audio, video, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the communications utility to the customer's communications equipment up to and including equipment such as a telephone, fax machine or answering machine defines _____.

   (a) limited-energy circuit
   (b) remote-signaling circuit
   (c) power-limited circuit
   (d) communications circuit

4. A communications raceway is an enclosed channel of nonmetallic materials designed for holding communications wires and cables in _____.

   (a) plenum
   (b) riser
   (c) general-purpose applications
   (d) all of these

5. A communications circuit that is in such a position that, in case of failure of supports or _____, contact with another circuit may result, and is considered to be exposed to accidental contact.

   (a) insulation
   (b) shield
   (c) fittings
   (d) grounding conductor

6. The point of entrance of a communications circuit is the point _____ at which the communications cable emerges from an external wall, from a concrete floor slab, or from a RMC or an IMC connected by a grounding conductor to an electrode.

   (a) outside a building
   (b) within a building
   (c) on the building
   (d) none of these

7. Communications circuits and equipment installed in a location that is _____ in accordance with 500.5 shall comply with the applicable requirements of Chapter 5.

   (a) designed
   (b) classified
   (c) located
   (d) approved

8. Communications cables and raceways identified as suitable for plenum use can be installed above a suspended ceiling or below a raised floor used for environmental air.

   (a) True
   (b) False

9. Equipment intended to be permanently electrically connected to a communications network shall be listed.

(a) True
(b) False

10. Access to equipment shall not be denied by an accumulation of communications _____ that prevents the removal of suspended-ceiling panels.

(a) wires
(b) cables
(c) ductwork
(d) a and b

11. Communications cables installed _____ on the surface of ceilings and walls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use.

(a) exposed
(b) concealed
(c) hidden
(d) a and b

12. Exposed communications cables shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable.

(a) True
(b) False

13. Accessible portions of abandoned communications cable shall be removed.

(a) True
(b) False

14. Openings around penetrations of communications cables and raceways through fire-resistant–rated walls, partitions, floors, or ceilings shall be _____ using approved methods to maintain the fire-resistance rating.

(a) closed
(b) opened
(c) draft stopped
(d) firestopped

15. Where overhead communications cables enter buildings, they shall _____.

(a) be located below the electric light or power conductors, where practicable
(b) not be attached to a cross-arm that carries electric light or power conductors
(c) have a vertical clearance of not less than 8 ft from all points of roofs above which they pass
(d) all of these

16. Outside plant communications cables shall not be required to be listed where the length of the cable within the building, measured from its point of entrance, does not exceed_____ and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector.

(a) 25 ft
(b) 30 ft
(c) 50 ft
(d) 100 ft

17. When practicable, a separation of at least _____ shall be maintained between communications cables on buildings and lightning conductors.

(a) 6 ft
(b) 8 ft
(c) 10 ft
(d) 12 ft

18. In installations where the communications cable enters a building, the metallic sheath members of the cable shall be _____as close as practicable to the point of entrance.

(a) grounded as specified in 800.100
(b) interrupted by an insulating joint or equivalent device
(c) a or b
(d) a and b

19. In one- and two-family dwellings, the primary protector bonding conductor or grounding electrode conductor for communications systems shall be as short as practicable, not to exceed _____ in length.

(a) 5 ft
(b) 8 ft
(c) 10 ft
(d) 20 ft

20. In one- and two-family dwellings where it is not practicable to achieve an overall maximum primary protector grounding conductor length of 20 ft, a separate ground rod not less than _____ shall be driven and it shall be connected to the power grounding electrode system with a 6 AWG conductor.

(a) 5 ft
(b) 8 ft
(c) 10 ft
(d) 20 ft

21. Limiting the length of the primary protector grounding conductors for communications circuits helps to reduce voltage between the building's _____ and communications systems during lightning events.

(a) power
(b) fire alarm
(c) lighting
(d) lightning protection

22. For buildings with grounding means but without an intersystem bonding termination, the grounding conductor for communications circuits shall terminate to the nearest _____.

(a) building or structure grounding electrode system
(b) interior metal water piping system, within 5 ft from its point of entrance
(c) service equipment enclosure
(d) any of these

23. Communications grounding electrodes must be bonded to the power grounding electrode system at the building or structure served using a minimum _____ copper bonding jumper.

(a) 10 AWG
(b) 8 AWG
(c) 6 AWG
(d) 4 AWG

24. Where communications wires and cables are installed in a Chapter 3 raceway, the raceway shall be installed in accordance with Chapter 3 requirements.

(a) True
(b) False

25. Communications cables installed in buildings shall be listed except for up to 50 ft past the point of entry as allowed by 800.48.

(a) True
(b) False

26. Communications wires and cables shall be separated by at least 2 in. from conductors of _____ circuits, unless permitted otherwise.

(a) power
(b) lighting
(c) Class 1
(d) any of these

27. Type CMX communications cables can be installed in _____.

(a) one- or two-family dwellings
(b) multifamily dwellings in nonconcealed spaces
(c) a or b
(d) none of these

28. Communications plenum cable shall be _____ as being suitable for use in other spaces used for environmental air.

(a) marked
(b) identified
(c) approved
(d) listed

29. Communications _____ cables shall be listed as being suitable for use in a vertical run in a shaft, or from floor to floor, and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

(a) plenum
(b) riser
(c) general-purpose
(d) none of these